MACHINERY

Index to Volume XLI
September 1934—August 1935

1935
THE INDUSTRIAL PRESS
140-148 Lafayette St.
New York

MACHINERY

Design—Construction—Operation

Volume 41 | SEPTEMBER, 1934 | Number 1

NRA
U.S.
CODE
GRAPHIC ARTS INDUSTRY
The Industrial Press

Machine Tools for the Shop of Today **is the subject of the leading article in October MACHINERY. This article summarizes the present trends in machine shop practice, as based upon numerous recent installations of shop equipment in progressive shops in every part of the country. A special section of the October number will also deal with progress in ferrous and non-ferrous materials, electric and gas welding, flame cutting and hard facing, based on exhibits that will be found at the National Metal Show in New York, October 1 to 5.**

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DEPARTMENTS

PUBLISHED MONTHLY BY
THE INDUSTRIAL PRESS
148 Lafayette Street New York
ROBERT B. LUCHARS...........*President*
EDGAR A. BECKER, *Vice-pres. and Treasurer*
ERIK OBERG ....*Editor*
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LONDON: 52-54 High Holborn
PARIS: 15 Rue Bleue

YEARLY SUBSCRIPTION: United States and Canada, $3 (two years, $5); foreign countries, $6. Single copies, 35 cents. Changes in address must be received by the fifteenth of the month to be effective for the forthcoming issue. Send old as well as new address.

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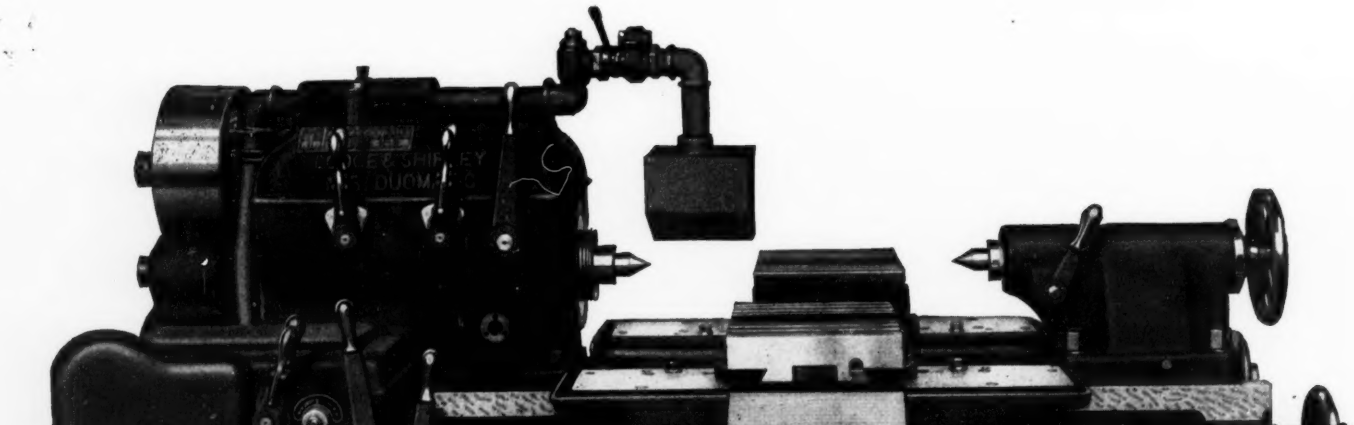


THE LODGE & SHIPLEY MACHINE

MACHINERY

Volume 41 NEW YORK, SEPTEMBER, 1934 Number 1

Broaching Independent Front-Wheel Suspension Parts

By WILLIAM A. HART
Engineer, Colonial Broach Co., Detroit, Mich.

No machining process has made such rapid strides during the past year as broaching. External broaching is now being applied to parts that no one ever thought could be finished or machined in this manner. The present article deals with some of these new applications and describes the highly developed fixtures that are now used for broaching operations.

IN view of the great amount of interest that has recently been paid by manufacturing executives of automobile plants to broaching possibilities, it was to be expected that this method of machining would be considered for many of the new parts used on this year's automobiles. Broaching was found to be particularly well adapted for finishing some of the parts that make up the independent front-wheel suspensions which have replaced the front axle on many cars. Several unusual broaching fixtures produced by the Colonial Broach Co. for machining such parts are described in this article.

In designing these fixtures, the method selected for locating and clamping the work-pieces had to be carefully studied to make sure that the parts would not spring out of shape after the broaching operation, because any misalignment of holes would result in inaccuracies in the steering mechanism and cause hard steering.

Although the parts broached by the methods to be described are all made of the toughest alloy steels, the broaches remove the metal quickly to a high commercial finish.

One of the important requirements in machining the steering-knuckle support seen in the broaching fixture illustrated in Fig. 1 is that the king-pin hole must be accurately located and be in close angular relation with the end holes by means of which the support is attached to the main axle assembly. The king-pin hole is rough-drilled previous to the broaching operation.

Both right- and left-hand steering knuckles are broached at the same time by means of this fixture, as will be seen from Fig. 4. Each steering knuckle is located on two pilots *A* and *B*, which are allowed to float vertically to take care of any variation between the locating holes in the work and the thrust-taking surface *C*. Hence, the broaching load is carried on surface *C*, and not on the locating pilots.

The broaches *D* are carried in ram attachment *E*. This attachment is provided with two bushings *F* which slide on bars *G* to insure alignment. Adapter *H* is allowed to float sidewise to offset any slight variations in the broaching machine.

Broaches *D* are so designed that at the start of the broaching cycle, the ends of the pilots travel through the parts and engage guide bushings *J* before the first tooth of the broaches enters the parts. From this point the broaches are guided both in the ram attachment above the work and in the guide plate *O* below the work. Plate *O* is kept in alignment by bushings *P* which slide on guide bars *G*. The guide plate, broaches, and ram attachment

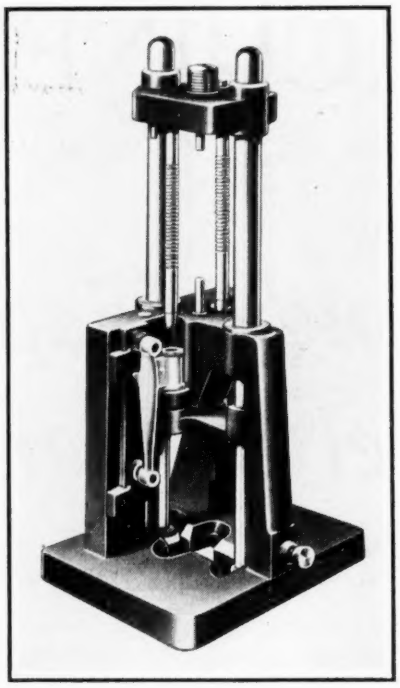


Fig. 1. Equipment for Broaching the King-pin Hole in Two Steering-knuckle Supports Simultaneously

move as one unit through the broaching cycle.

After the last tooth of the broach leaves the work-piece, plunger *K* engages stop-pin *L* and releases the broach from the ram attachment. Both broaches drop through the finished holes and are stopped with their upper ends below the work. In the lowest position of the ram, the bushing plate engages latch *M*, so as to retain the lower guide and the broaches when the ram attachment moves upward. The parts can now be removed from the fixture. Upon the release of latch *M*, the guide and broaches are automatically raised by counterbalance weight *N* and again engaged with the ram attachment, completing the cycle. This fixture is used in an Oilgear 10-ton machine.

Broaching the Bosses on a Motor Bracket

The four faces of the front bosses *A*, Fig. 5, of a motor bracket and two locating spots *B* are rough- and finish-broached from the rough forging. In order to obtain maximum production in this operation and reduce the lost time due to the return stroke of the ram, it was decided to use a tilting fixture which would allow the part to be loaded and unloaded during the return of the broaches to their top positions. Fig. 2 shows the appearance of the fixture designed, while Figs. 5 and 6 give its details.

In designing this fixture, a method of locating the rough forging had to be devised by means of which the stock left for machining would be evenly distributed at all times, even after considerable wear of the forging dies had taken place. This was accomplished as follows: The part is placed in the fixture with its rear boss *C* entering a V-shaped plunger *D* which locates the boss in one direction. Then two equalizing clamps *E* are brought together to grip the part with their V-shaped ends *F*, thus locating the boss sidewise and up and down. After the rear boss is fixed in all directions, the V-shaped end of a second spring plunger *G* is brought against one arm of the part by means of a hand-knob *H*. This brings the bosses in the proper relation to the broaches.

Now, having been positively located in the fixture, the part is ready to be gripped by two power-

Fig. 2. Six Broaching Cuts are Taken Simultaneously on a Motor Bracket with this Equipment

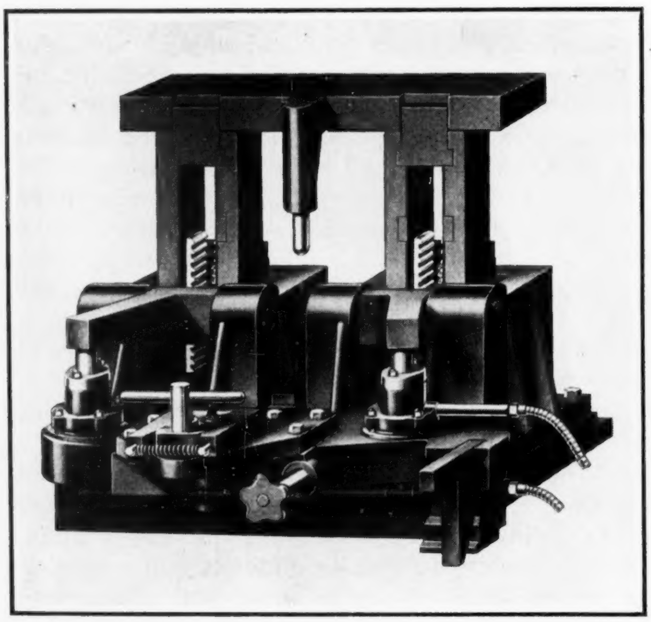
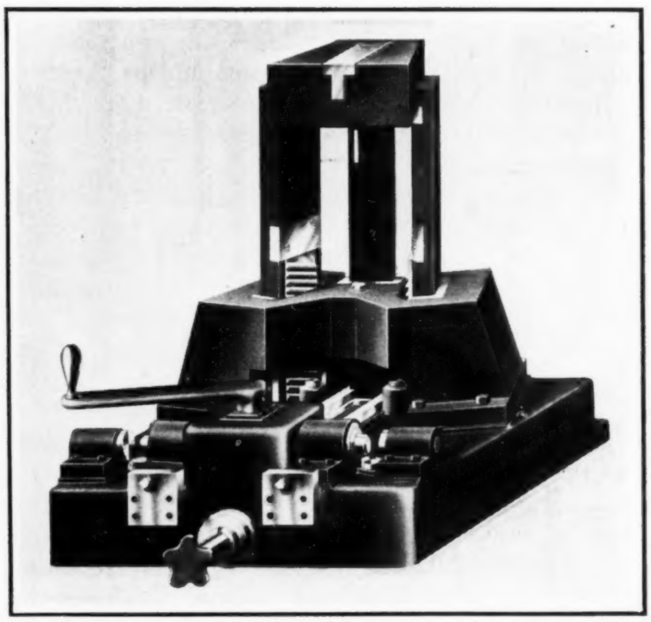


Fig. 3. Three Additional Cuts are Taken on the Motor Bracket with the Broaches of this Fixture



ful hydraulic clamps *J*, which are actuated by double-acting built-in oil cylinders *K*. Each clamp swings on a pin *L*, which is held in two bosses *M*. The clamps grip the part between hardened and serrated steel blocks *N* and hold it positively in place against any side thrust of the broaches.

The part is now ready for broaching. By means of handle *O*, latch *P* is released to permit the fixture to swing into the broaching position. It comes to rest on two stop-blocks *Q* which give support to the work directly under the cuts. The latch *R* locks the fixture in this position. When the machine is tripped and starts on its downward stroke, broaches *S* are guided on all sides by hardened and ground steel plates *T* for the length of the cut.

Near the bottom of the cutting stroke, spring plunger *U*, as it descends with the ram attachment, strikes latch *R*, releasing the fixture and allowing it to instantly swing out of the cut under its own weight. This gives a free passage to the returning broaches, and the fixture can be quickly reloaded during the return stroke. This operation is performed in an Oilgear special 20-ton press.

Two angular faces and one face of the rear boss are broached simultaneously on the same motor bracket by employing the equipment shown in Figs. 3 and 7. Accurate location of the part for this operation was not difficult, because reamed holes were available in the rear boss *A* and in front bosses *B*. For loading, the part is pushed over guide rails *C* and on locating stud *D*. The front bosses *B* are supported by rest buttons until they are picked up by studs *E*.

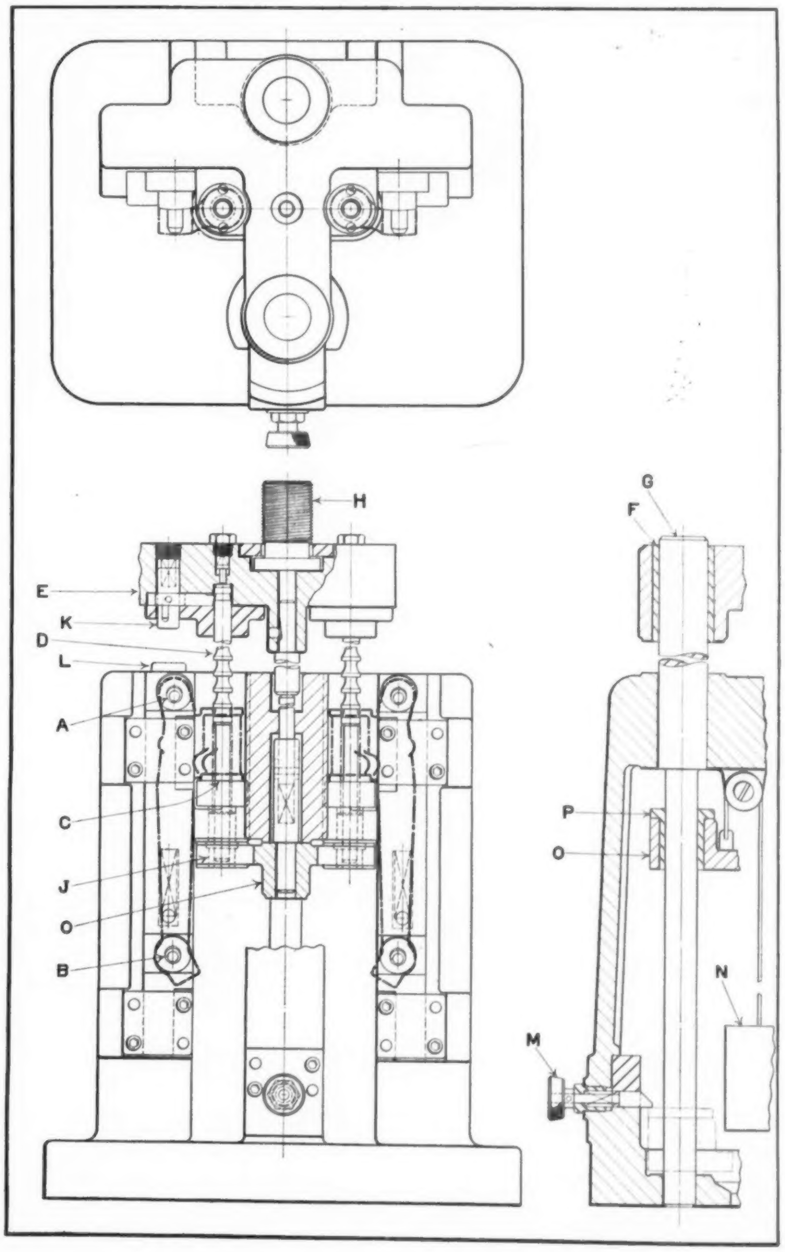


Fig. 4. Details of Fixture Shown in Fig. 1, Designed for Broaching the King-pin Hole in Steering-knuckle Supports

The operation of these studs presented quite a problem, because they not only serve as locators, but also push the previously finished face *F* of the part against the shoulder of stud *D*. This action was accomplished by making guides *G* angular, so that as the studs come forward, they also move sidewise sufficiently to lock the part in the desired position. Guides *G* are operated by a double-acting positive-retracting cam *H*, which is enclosed by housing *J*.

The cutting thrust of rear broach *K* is taken entirely by stud *D*; however, adjustable sensitive stops had to be provided to take the thrust of the angular broaches *L*. By pushing in hand-knob *M*, wedges *N* are actuated through an equalizing lever *O*, thus raising plungers *P*. When the operator feels the plungers make contact with the part, he turns the hand-knob, which locks the whole mechanism. When shaft *Q* is turned, it screws into its combined bushing and nut, so that its tapered section forces three wedges *R* against an outer bushing. This keeps the shaft from creeping back.

In operation, the ram attachment *S* forces the broaches through the cut. Broaches *L* are connected permanently to the ram attachment, whereas broach *K* is held by latch *T* until it is released at the end of the stroke. This broach, guided in lower

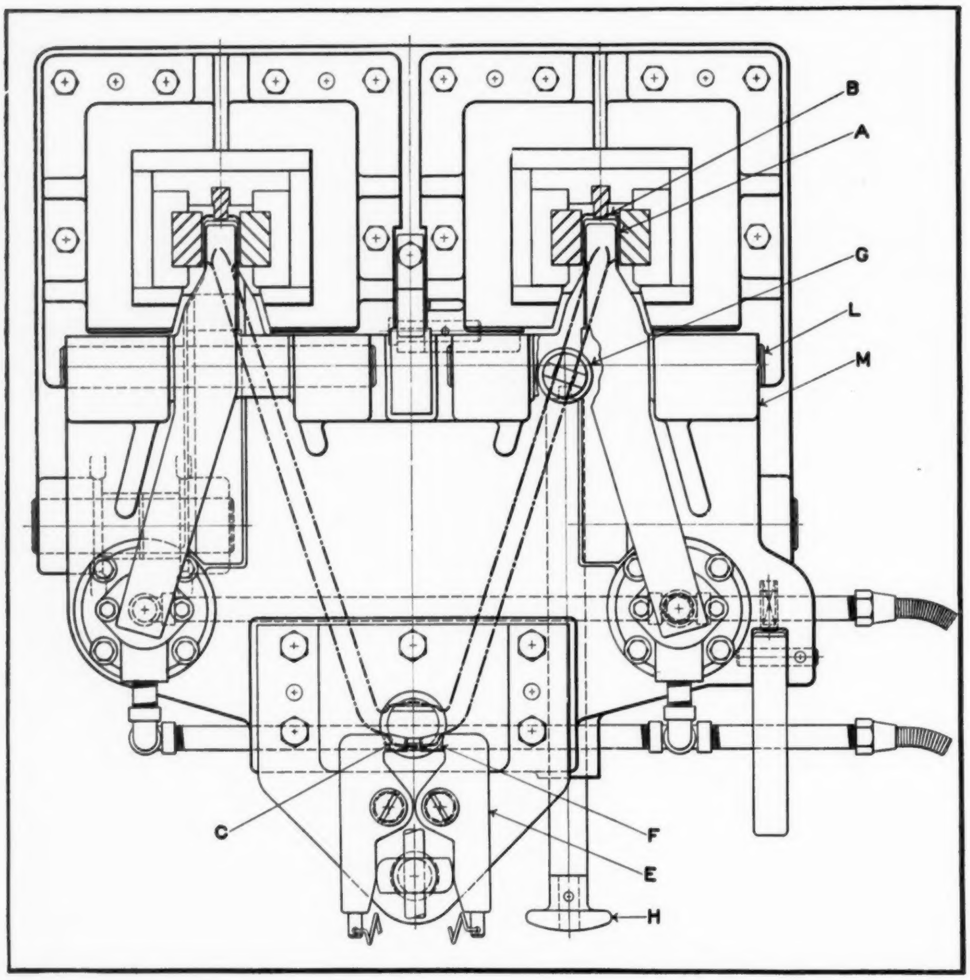


Fig. 5. Tilting Type of Fixture Used for Rough- and Finish-broaching Cuts on a Motor Bracket

bracket U, must drop with its rear pilot below the part, in order to permit unloading. After the part is taken out, a pneumatic cylinder (not illustrated) returns the broach to the ram attachment. It is automatically connected to the attachment by latch T and returned to its top position.

Broaching Flat Surfaces on Front-Wheel Control-Arm Pins

At A in Fig. 10 is shown a front-wheel control-arm pin which has a threaded body in the middle and two flats on both ends. The important requirement in broaching this part is to produce the flats in true relationship to the pitch diameter of the threads and still maintain a high rate of production. The fixture developed to meet this requirement is shown in Figs. 8 and 10.

To locate the pin by its threaded body, it is placed between threaded split jaws, after which it is screwed in against a positive stop to obtain end location. It would have been difficult to perform this loading operation inside a fixture at high rates of production, and so the fixture was designed to receive a cradle B, which is loaded and unloaded on a bench. This cradle is also shown in Fig. 9.

The loading cradle consists of two split threaded bushings C, Fig. 10, the outer halves of which are pivoted at the top. They are held open or closed by spring pressure. In loading, the work parts are placed in the open cradle, the two threaded halves are swung in to grip the parts on the thread with spring pressure, and each part is screwed against positive stop D. The cradle is then inserted in the fixture and clamped by cam E ready for broaching. During the broaching operation, the operator unloads and loads a second cradle, thereby practically eliminating all lost time.

Broaching the Base of a Stabilizer Housing

The flat base A of the stabilizer housing shown by the dot-and-dash lines in Fig. 11 constitutes a typical flat broaching job. Straightness and a high quality finish of the surface are obtained in this operation at high production rates. A photograph of the fixture is reproduced in Fig. 12.

To facilitate loading, a shuttle fixture was devised for this operation. Shuttle B, which carries the locating and clamping members, is operated by an air cylinder, built into the stationary part of the fixture at C. When the shuttle is in its "out" position, the part is loaded between hardened and ground locating blocks D and E. Block D is adjustable sidewise by means of screws F to suit variations in the width of the castings. The part is backed up against the pressure of the cut on the flanges by these blocks. The thrust face of block D

is solid, while block E is provided with an equalizer G which bears against the rough casting.

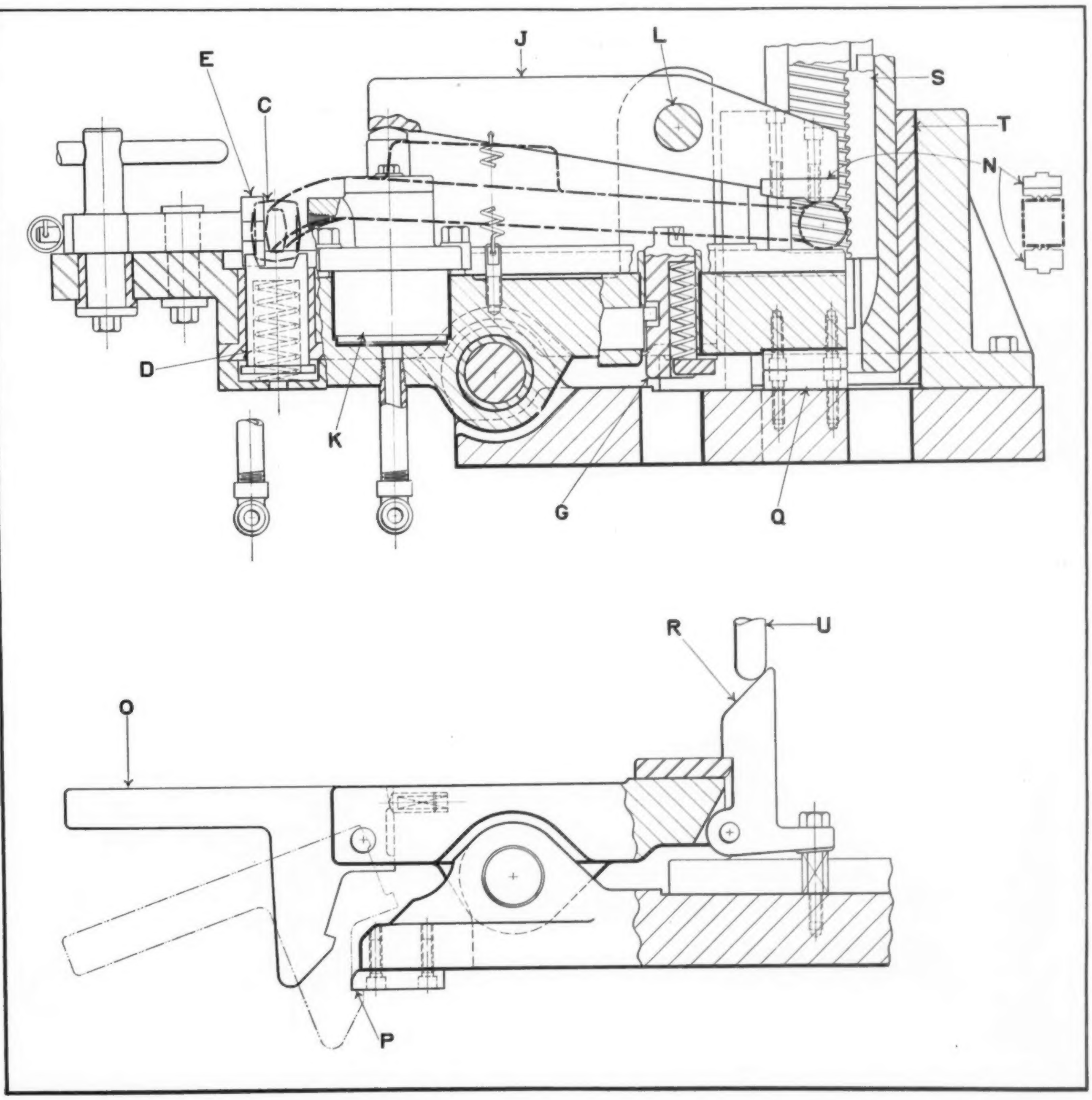
When the stabilizer housing has been placed between blocks D and E, sliding clamp H is brought forward by pins in cam J engaging corresponding holes in the clamp. When the clamp is in its foremost position, the rise on the cam forces it down, bringing the work-piece solidly against rest buttons K. An air control button is then depressed, setting an air piston in motion which pulls the shuttle into the broaching position and holds it against stop-button L.

After broach M has passed through the work and is near the end of its stroke, a cam on the broach bar reverses the position of the air valve. The air piston then pushes the shuttle away from the broach into the loading position, where it is unloaded by the operator while the broach returns to its top position.

Fig. 6. Sectional and End Views of the Broaching Fixture Illustrated in Fig. 5

The examples of broaching practice illustrated and described in this article are an excellent indication of the possibilities of the application of this machining method. The broaching equipment that has been developed during the past year—one might almost say during the past few months—has opened up an entirely new field for the broaching process, and has made it possible to apply it to parts that no one would have proposed to finish or machine in this manner a few years ago. The automotive plants especially are applying broaching in place of former machining methods to an ever increasing extent. This is particularly true of external or surface broaching applications.

While a fairly high pro-



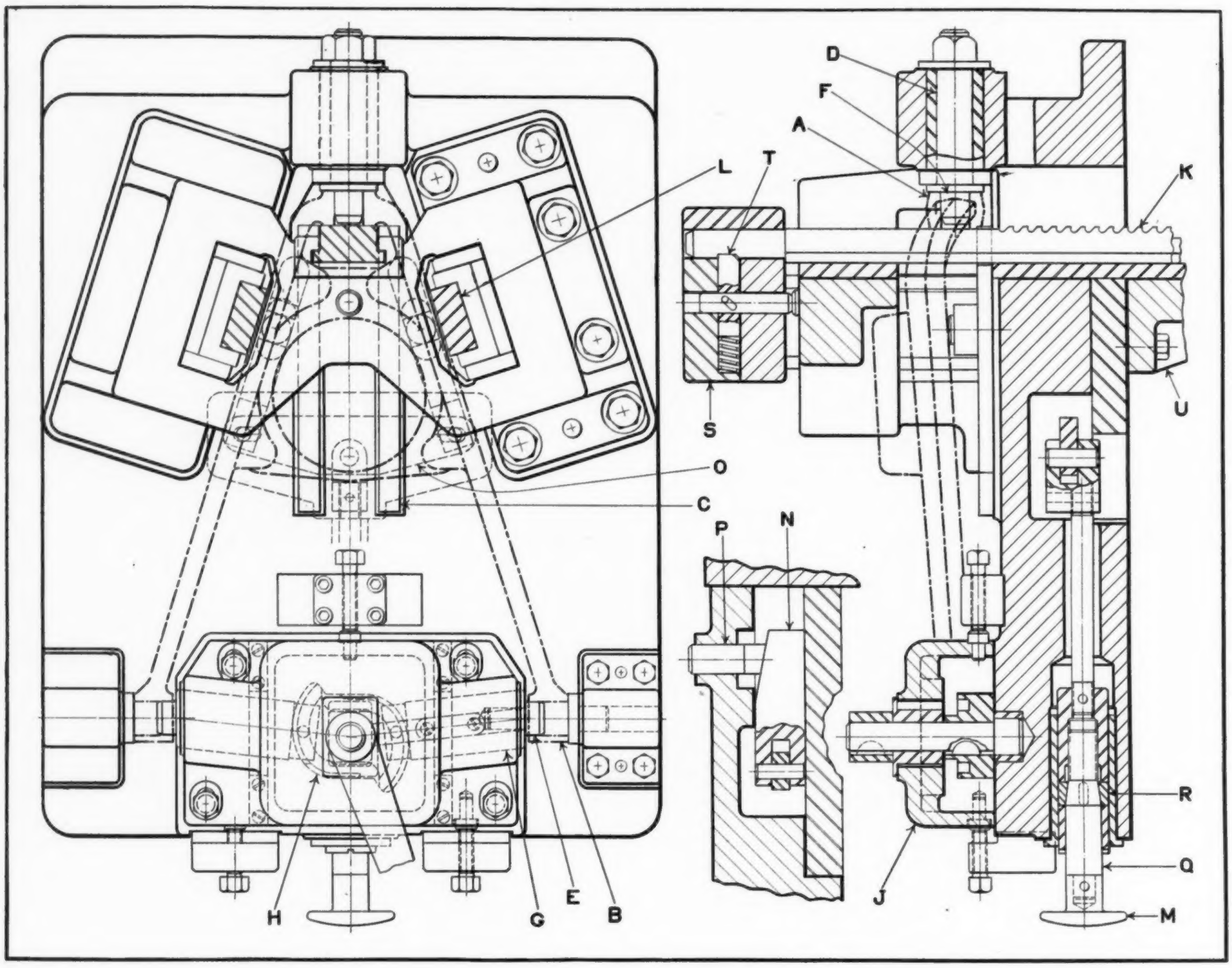
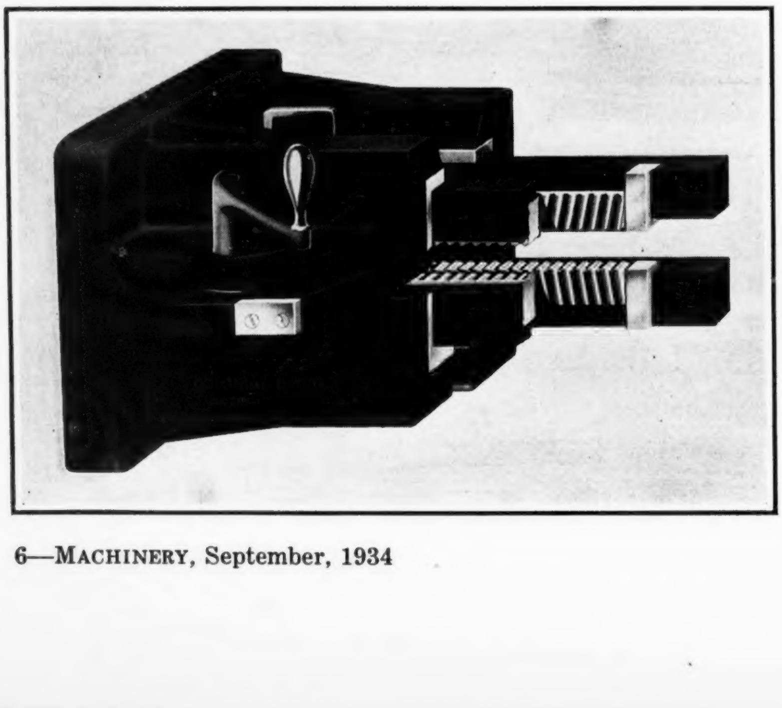


Fig. 7. Details of Construction of the Broaching Fixture Illustrated in Fig. 3

Fig. 8. Four Broaches Used in this Fixture Machine Flats on the Ends of Pin A, Fig. 10

Fig. 9. Work-loading Cradle that is a Feature of the Fixture Shown in Fig. 8



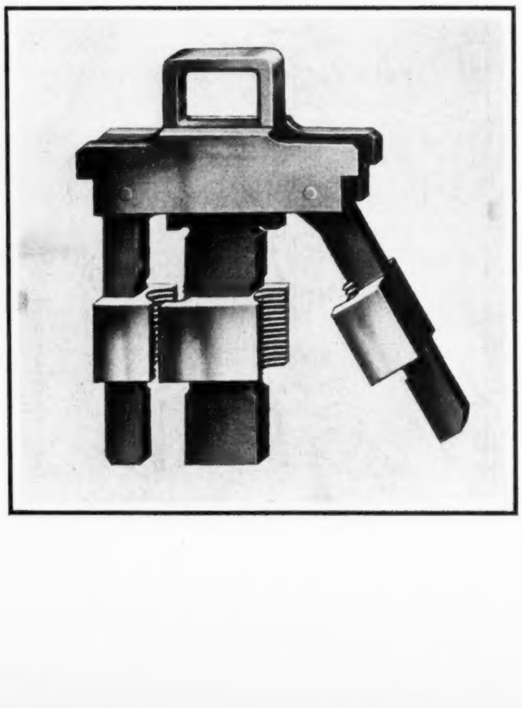
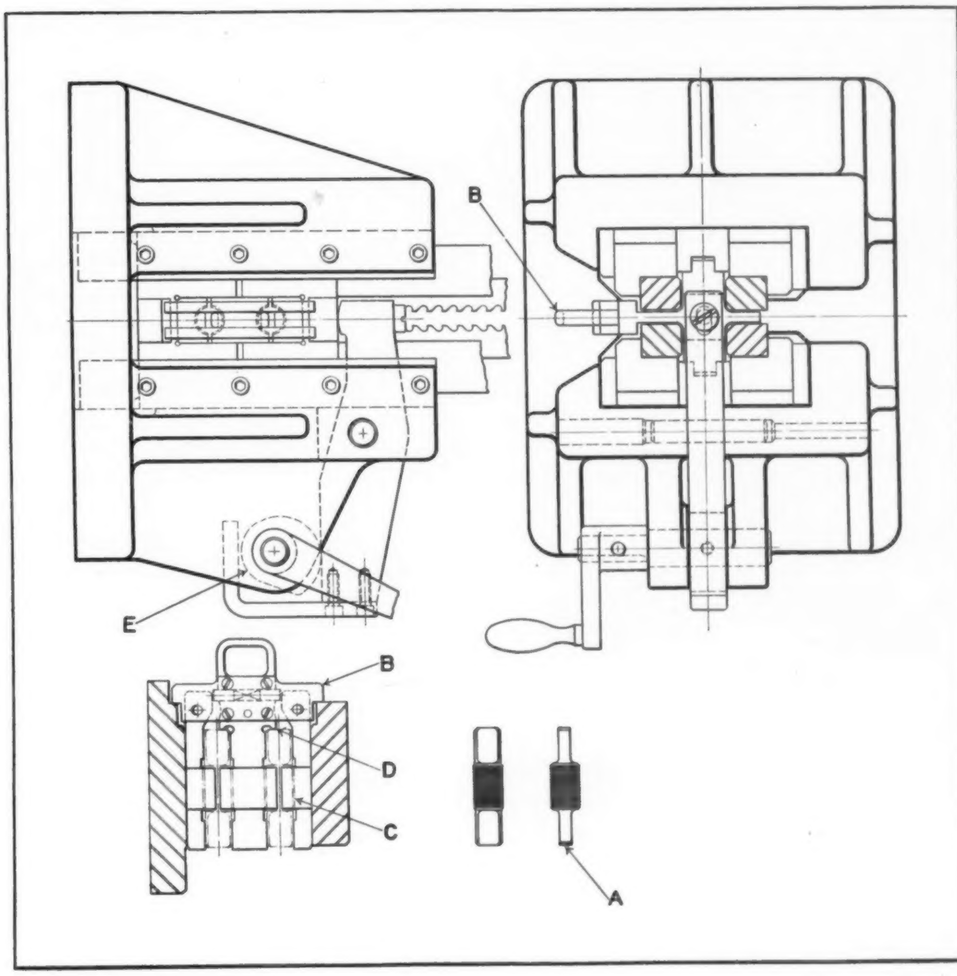
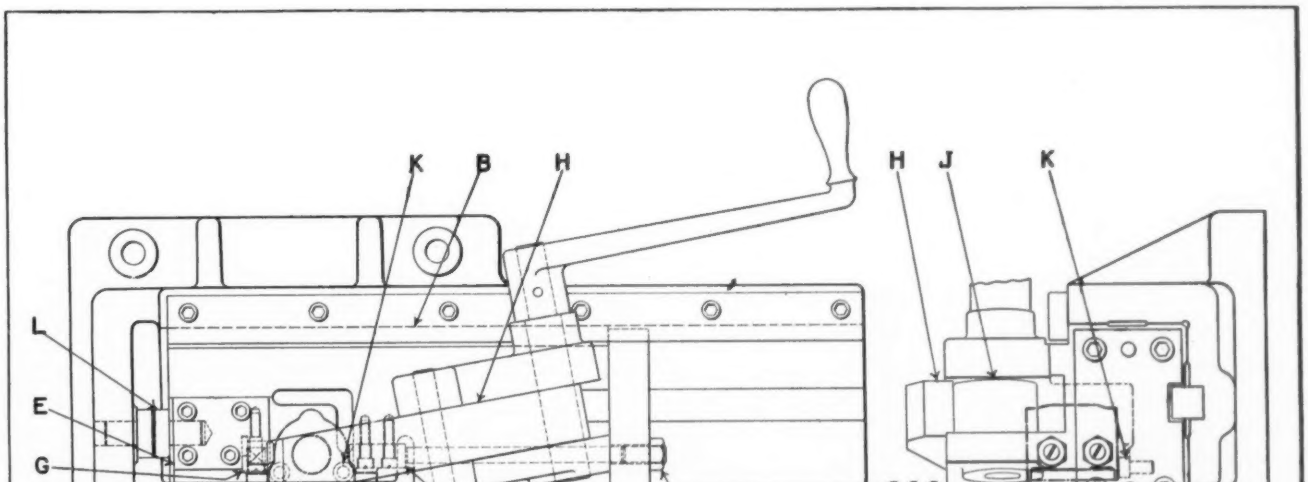


Fig. 10. (Right) Equipment Designed for a Part that has Four Surfaces Broached in Accurate Relation to a Threaded Body

Fig. 11. (Below) Design Details of Fixture Shown in Fig. 12, which has an Air-operated Shuttle for Moving the Work to and from the Broach





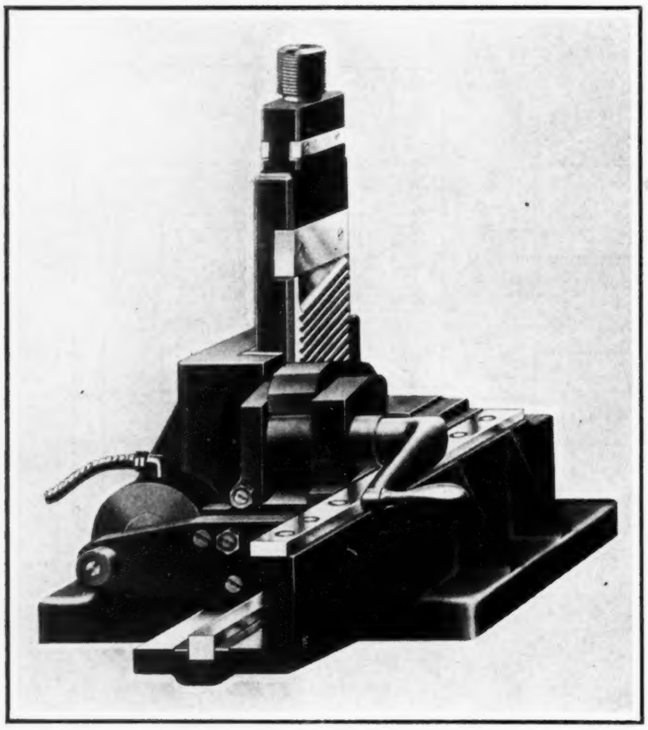


Fig. 12. Fixture Provided with a Shuttle for Sliding the Work into and out of the Broaching Position

duction is necessary in order to make broaching pay, the method is decidedly cheaper and faster than any other machining method where it is applicable. Furthermore, properly made and applied broaches have a long life and the upkeep expense is comparatively small. Production engineers agree that the broaching principle has come to stay and that it will revolutionize many of the machining methods of today.

* * *

A Treatise on Materials-Testing Machines

In a periodical publication entitled "Baldwin Locomotives," distributed by the Baldwin-Southwark Corporation, Philadelphia, Pa., a treatise is now being published on the development of the tension-compression-transverse group of testing machines, with particular reference to the evolution of the Southwark-Emery type of machine. This, we believe, is the first complete historical account in any language of materials-testing machines. It contains a series of illustrations of testing methods as far back as 1638. It is to be hoped that at a later date the author, C. H. Gibbons, advertising supervisor of the Baldwin-Southwark Corporation, will assemble this interesting information in book form, to make it permanently available to engineers and others interested in testing machines and their development.

Eight Basic Principles that Apply to Industrial Publicity

The following suggestions for publicity managers are given in "Bacon's Publicity Manual" published by R. H. Bacon & Co., Chicago, Ill. They are quoted because adherence to them will promote successful cooperation between advertising and publicity managers and trade journals.

1. Editorial material should be analyzed from the standpoint of its news value to the field in which placement is desired.
2. Commercial considerations should be subordinated to reader interest. Publicity supplements advertising—it cannot replace it.
3. Where broad distribution is desired, a release date should be set far enough in advance so that monthly and semi-monthly publications will be able to use the material on approximately the same date as daily and weekly publications.
4. If the same general material is to be sent to publications in various market groups, the articles should contain some interpretation based on the reader interest of each group.
5. Editorial material on new equipment, new catalogues, etc., should appear, whenever possible, prior to any advertising on the same subject.
6. Articles should be as complete as possible, including titles, sub-titles, and captions for illustrations.
7. Cuts made to specifications, or electrotypes, should be offered.
8. Don't work mimeographing or multigraphing machines over-time on publicity—give the typewriters a chance—fewer and better releases may produce more effective results.

* * *

Arc Welding Saves $200 in Press Repair

Arc welding saved $200 for the Defiance Pressed Steel Co., Defiance, Ohio, in the repair of a cast-iron press frame which had broken at one bearing. In addition, the press was back in service thirty-six hours after the break occurred. The Menna Welding Co., of Toledo, prepared the break for welding by cutting away enough of the cast iron around the break to permit the insertion of a number of steel studs—the customary practice with cast iron in order to obtain a strong, solid joint. The operator then applied a double layer of General Electric Type A welding electrode, which gave a layer of metal strongly bonded to the cast iron. Type F electrode was used to fill in the remainder of the gap on both sides of the bearing because of the saving in time and cost afforded by this particular electrode. In all, about 75 pounds of electrode were consumed in the repair. The cost of a new frame, exclusive of its installation, would have been $200 greater than the cost of the welding job, and the press would have been idle longer.

Minimizing Bearing Troubles with Self-Lubricating Bronze Bushings

The Application of Self-Lubricating Bearing Bushings of Porous Bronze Type has Helped Reduce Costs, Promote Silent Operation, and Solve Lubrication Problems

By HERBERT CHASE
Consulting Engineer

SEEMINGLY minor defects in bearing design, construction, and lubrication have caused manufacturers of electric motors and motor-driven machines countless difficulties and heavy expense before they could be corrected. Conversely, freedom from difficulties of this kind invariably means much to the manufacturer in building up his reputation as a maker of trouble-free products. For this reason, a study of the progress made in eliminating bearing troubles by means of porous bronze bearings is of special importance.

Although the porous bronze class of bearing is not new, there are constantly being developed new and ingenious applications that give not only prolonged service, but often effect substantial economies in the manufacture of the machine in which the bearings are used. The writer is indebted to the Bound Brook Oil-Less Bearing Co. for particulars about the designs here described. In these designs, the bearings employed are of bronze, but are not cast in the usual way. They are composite bearings, formed initially under heavy pressure from powdered metals and graphite. The pressed composition is subjected to a temperature high enough to convert it into a true alloy resembling cast bronze, but much more porous. In the final finishing operation, the bearings are brought within unusually close dimensional limits in a die that gives the bearing a high burnish, no reaming or other machine work being required.

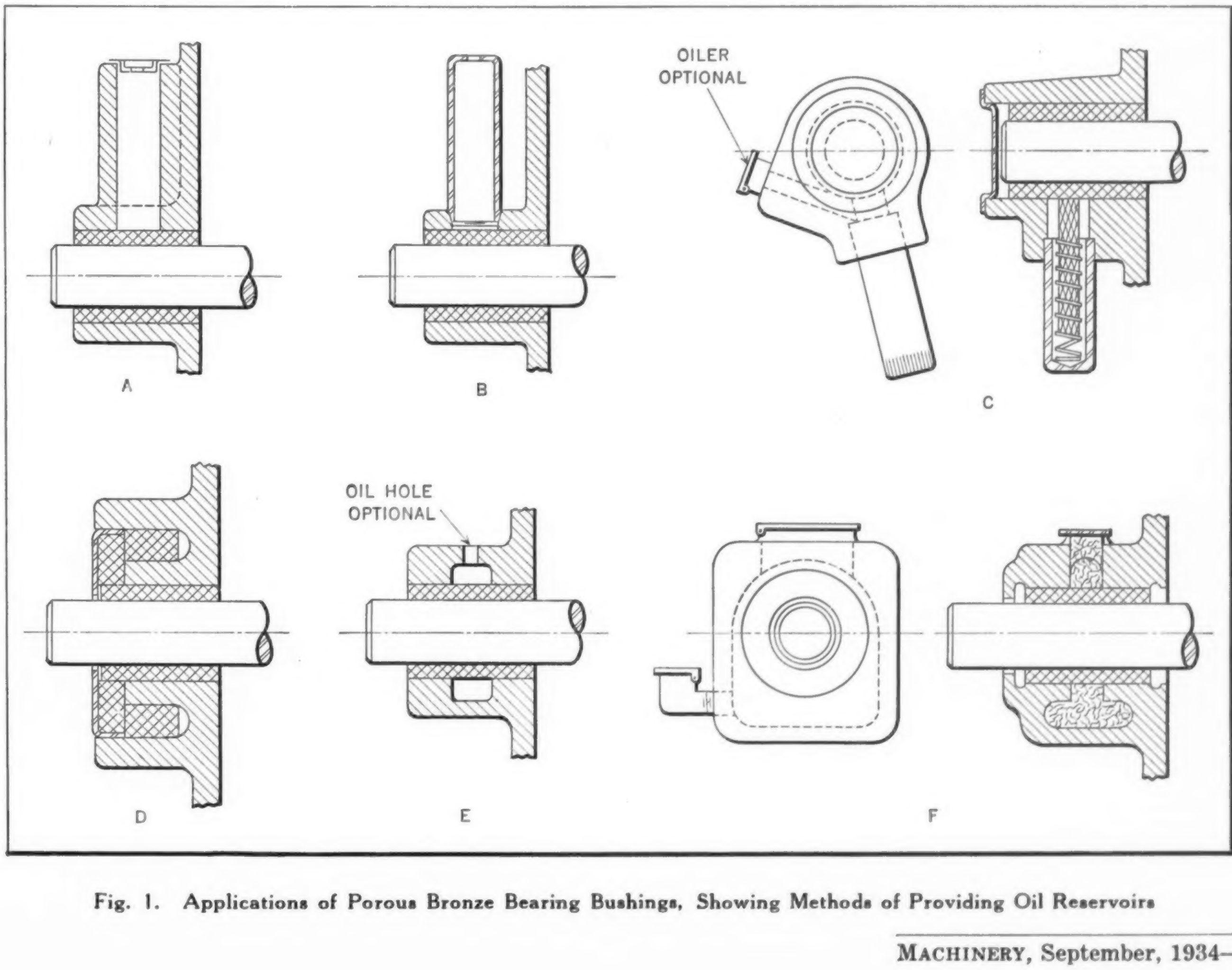


Fig. 1. Applications of Porous Bronze Bearing Bushings, Showing Methods of Providing Oil Reservoirs

Because of its porous structure, this type of bearing, when soaked in oil, absorbs oil to the extent of 25 to 35 per cent of its own volume. The free graphite content of the material, supplemented by the absorbed oil, has an important effect upon lubrication and permits the use of designs, many of which would not be feasible otherwise. Engineers of the company making these bearings state that, even under tests involving very high speeds and loads, they have never found a bearing of this type to seize or cut the shaft.

These composite type bearings have, except for their graphite content, about the same composition as cast bronze bearings, namely about 10 per cent tin and 90 per cent copper. In certain instances, small percentages of zinc are added. Initial forming of the powdered materials, which pass a 200-mesh screen, is done under a pressure of about 20 tons per square inch, without any binder. In this form, the "pressing" has only enough strength to permit of handling. After it has been subjected to a temperature of 1500 degrees F. for ten to twenty minutes, cooled, and put through the sizing die, it has a compressive strength of about 60,000 pounds per square inch. It is, in fact, nearly as strong as a cast bearing.

Bearings are Pressed to Size and Require No Machining

Bearings made in this manner need not be complete cylindrical shells, although this is the most frequently used form. They are often made in half-bearings, which fit together perfectly without any subsequent machining. They may be spherical or they may have any other odd shape, so long as the shape lends itself to production in a die.

Flanged bearings, such as are often used to take thrust as well as radial loads, are readily formed. Bore diameters are easily held within 0.0005 inch of nominal size, and other dimensions within 0.001 to 0.005 inch, plus or minus, or even closer limits. This applies to bearings as they come from the finishing die without reaming or other machine work on any surface.

Although the cost of a given number of composite bearings made in this way naturally must include that of the die, the elimination of machine work on the bearing usually brings the cost per piece down to or below that of a finished cast bearing, if the quantity required is fairly sizable. In other instances, particularly where special shapes are required, the cost may be considerably lower than for a machined bearing, and may even make the use of such a shape feasible in instances where its cost would be prohibitive if production by machine methods were required. In other cases, especially for large-size bearings required in comparatively small quantities, cast bearings may cost less, but they do not have the porous, oil-holding qualities.

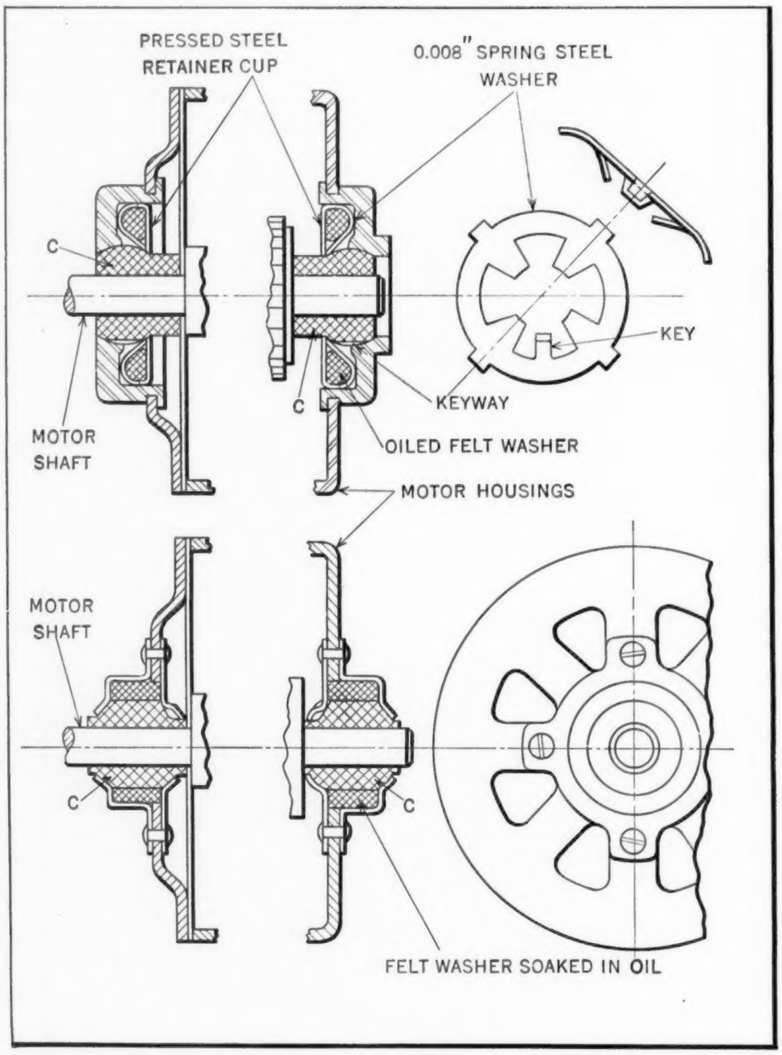


Fig. 2. Cross-sections of Two Small Electric Motor Bearings, Showing How Compo Porous Bronze Bushings C are Fastened to the Pressed-steel Frames

Properties of Porous Bronze Bearings

The porous bronze type of bearing is low in cost, quiet in operation, easy to protect against dust, and is not subject to rust. As the accompanying illustrations show, self-aligning features are made use of in these types, and at very small added cost, as compared with types that are not self-aligning. Many porous bronze bearings are made interchangeable with anti-friction bearings by the addition of a pressed-metal shell, which can be cadmium-plated if desired and which is readily formed with a spherical seat for the oilless insert, thus making the bearing self-aligning. In addition, such units usually have within the pressed-metal shell an oil-soaked felt washer from which oil is fed slowly

through the porous metal of the bronze bushing. In many applications, the oil absorbed by the bushing and felt washer is sufficient to last for the life of the machine of which they form a part. In other cases, provision for feeding additional oil, as required, is made in the bearing support or holder.

One way in which porous bronze bearings differ from the conventional plain type of bearing is in the manner in which the oil is fed to the bearing surface. No oil-holes or oil-grooves are required, and if a wick or felt for feeding extra oil is employed, it is not brought into contact with the shaft where it would become glazed or worn away and thus rendered ineffective. Oil that comes in contact with the outer surface of the porous bushing feeds slowly through the pores, replacing the oil already in the bearing as the latter is slowly consumed. Thus the shaft is always wet with oil, but the feed is slow enough to prevent the oil from dripping.

Method of Installing Straight Bushings

Referring now to specific applications, illustrations *A* and *B*, Fig. 1, show typical installations of straight bushings with provisions for feeding oil by gravity, as required. The view at *A* shows a cast recess for the oil. At *B* a tube is shown screwed into the bearing boss with a tapered pipe thread, the tube having a small hole in its closed end through which oil may be added. In both cases, the bushings are pressed into place and so prevent any oil leakage at the outside diameter of the bushing. The only place for the oil to escape is by feeding to the shaft through the pores of the bushing. As the maximum possible pressure head is very small, the feed through the capillary openings in the porous metal is only fast enough to replace the oil used by the bearing.

At *C* is shown a wick feed from a cylindrical cup pressed or screwed into the lower side of the bearing boss. The wick is pressed against the outside of the bushing by the spring, and feeds plenty of oil, but never touches the shaft. A pressed-metal cap seals the outer end of the bearing against dust and dirt. The small oil opening with a spring cap, to facilitate filling the reservoir, is optional.

Annular recesses for oil can be cored or otherwise cast in the bearing bosses, if desired, as shown at *D*, *E*, and *F*. With the construction shown at *D*, the annular openings are filled with two oil-soaked felt washers which feed oil slowly to the porous bushing. A metal cap, pressed in place, seals the felts and prevents entry of dust and dirt. With the constructions shown at *B*, *C*, and *D*, and with many other similar installations, very little if any of the oil provided can be lost in shipment, regardless of the position in which the bearing might be placed. With the construction shown at *E*, if the annulus is filled with light grease prior to assembly, no oil-hole will be required, as the oil in the grease feeds readily through the porous bushings. The same construction with an oil-hole is suitable for filling with

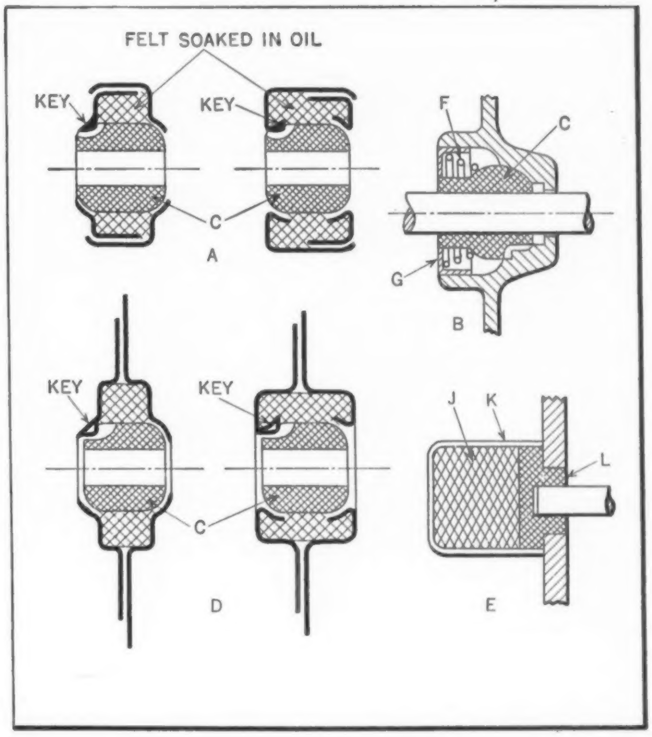


Fig. 3. Examples of Shaft Bearing Assemblies in which Self-lubricating Bushings are Used

oil after the bushing is pressed in place or could be used with an Alemite greasing connection if preferred. If packing with wool waste for oil-feeding to the outside of the bushing is desired, the construction shown at *F* is one of several alternatives.

Examples of Self-Aligning Bearing Installations

A simple application of spherical-seat self-aligning bushings to a small motor with a pressed-steel frame and end plate is shown in Fig. 2. With the constructions shown in the upper views, stamped spring-steel washers, formed as shown, are used to hold the bushings against their seats. These washers are pressed into place, the external ears gripping the metal of the seat and the key at the center fitting a recess formed in the bushing to prevent it from rotating in its seat, without interfering with its self-aligning action. Pressed caps back up the washers and serve to hold oil-soaked felts against the outside of the bushings.

With the alternative construction, shown in the lower views, flanged and cupped bearing holders made from pressed metal are riveted to each end frame. These stampings form the spherical seats and also enclose oil-soaked felts. Integrally stamped keys prevent rotation of the bearings in their seats. In most inexpensive motors, the felts and bushings hold oil enough to last as long as the motors themselves.

A shoulder on a shaft which rests against one end of a porous bushing may serve to take the end thrust. A hardened steel washer is often inserted

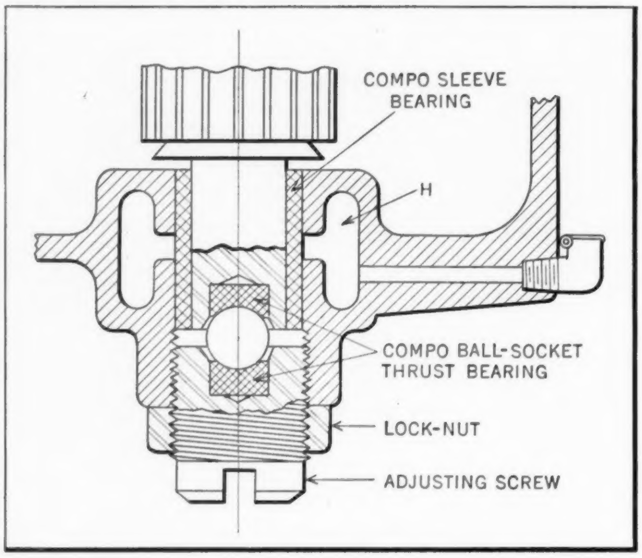


Fig. 4. Single-ball Thrust and Radial Bearing of Porous Bronze Applied to a Vertical Motor

against such a shoulder to provide a larger bearing surface. In order to reduce the weight of a hand-type vacuum cleaner motor, it was designed to run at a very high speed, namely, 22,000 revolutions per minute. Before the adoption of composite bearings for this motor, a set of the bearings was given a continuous test for 300 hours at the speed named. The bearings performed acceptably and with less noise than the type of bearing previously used.

Different Arrangements of Self-Aligning Units

As will be apparent from Fig. 3, there are several ways of making the self-aligning units. One class of assembly is made to duplicate in external dimensions the type of bearing previously used for similar equipment. In other instances, assembly may be facilitated by shaping the end housing of the motor to form half of the spherical seat and the recess for holding the oil-soaked felt.

The arrangement of a self-aligning bearing in a spherical seat cast in the end plate of a six-volt fan motor is shown at *B*. In this application, a short conical coil spring *F* holds the bearing against its spherical seat. A pressed-steel cup *G* serves to retain spring *F*. This arrangement provides for a very free self-alignment.

When it is desired to use a single ball for a thrust bearing in a vertical motor, the seats against which the ball bears can be made from porous bronze without any machining and can be applied as shown in Fig. 4. In this case, a conveniently adjustable screw with a lock-nut can be provided if desired, as the illustration indicates, and the radial bushing can be of the porous type with an annular space *H* for wool wicking.

For light mechanisms, such as electric clocks, recording instruments, film projectors, and the like, a simple flanged bearing such as that shown at *L*, Fig. 3, serves admirably, costs very little, and is quickly and easily installed. Such bearings can be pressed into place and staked, if desired. A thimble *K* or cup filled with light grease or oil-soaked felt *J* is then pressed over the bearing flange. The lubricant feeds slowly through the porous bearing and lasts for the life of the machine. Bearings of this type with flanges as small as 1/4 inch in diameter or smaller are now used successfully in large quantities.

Bushings such as shown in Fig. 1 are furnished with their edges slightly beveled to facilitate insertion and with the outside diameter so sized that after insertion the bore will be within the limits specified.

When they are used as inserts for die-castings, as is often done, bushings are usually furnished without impregnation with oil, as the latter is likely to be burned out by the molten metal during casting. In other cases, the bearings come soaked in oil and ready for use immediately, without need for soaking with oil after insertion.

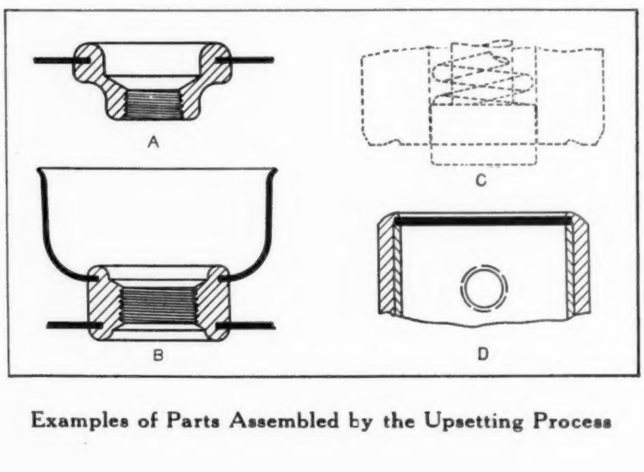
* * *

Assembling Parts by the Upsetting Process

The assembling of units by the process known in general as "riveting," but more specifically as "upsetting," has many applications. Three examples of work assembled by upsetting the metal to form a tight joint are shown in the accompanying illustration. These parts were assembled by hydraulic presses built by the Metalwood Mfg. Co., Detroit, Mich.

At *A* is shown an inserted threaded plug "upset" to form a finished joint at one operation. The method of attaching a filler cup or other part to a main receptacle at one operation through the medium of a threaded union is illustrated at *B*. The contour and the dimensions of the upset part are held to close limits. At *D* is shown a metal cap or disk cover assembled in a grease cup for a steering knuckle by means of the upsetting punch or die *C*.

This process has many applications, and designers in general will readily see its possibilities.



Examples of Parts Assembled by the Upsetting Process

When Should Welded Structures Replace Castings?

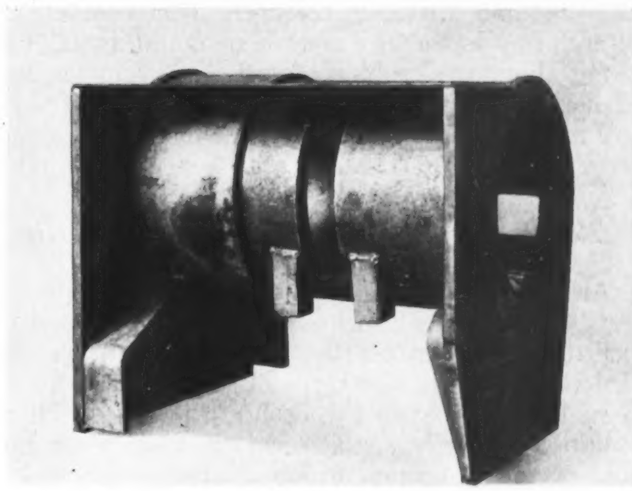


Fig. 1. Welded Structure that is More Economical to Manufacture than the Redesigned Casting Illustrated in Fig. 2

Whether a Casting or a Welded Structure is More Advantageous for a Given Purpose Depends upon Simple Fundamentals

By J. L. BROWN, Industrial Motor Engineering Dept.
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THE increasingly broad application of the electric arc as a manufacturing tool brings to the mind of the conservative engineer the question as to what extent welded structures can *economically* replace steel and iron castings. In answering this question, it is necessary first to give some thought to the design of the casting which it is proposed to replace with a welded structure. Sometimes great savings have been shown by replacing a casting with a welded structure, simply because the casting had not been skilfully designed and was therefore needlessly expensive. In many cases, greater savings could be effected by redesigning the casting and perhaps fabricating a portion of the structure than by substituting a completely welded design.

Some Causes of Expensive Castings

The reason for expensive cast designs is perhaps threefold:

1. The unfamiliarity of designers with patternmaking and molding, and the general conviction that a pattern can be made for casting any desired shape.
2. The general feeling of patternmakers that a part must be made exactly as shown by the blueprints and that suggestions are not in order.
3. The absence in the past of any competitive method of construction which might focus attention upon the expensive features of a cast design and compel simplification from the standpoint of molding and casting.

Were the designer and patternmaker one and the same person, as a designer he would avoid those features that would handicap him as a patternmaker; and as a patternmaker he would have the knowledge of molding and casting that would assist him as a designer to achieve an economical design. What is obviously necessary in the common situation where designing engineers and pattern and foundry experts are physically separated from each other is a persistent dissemination among the engineers of the knowledge possessed by the pattern and foundry experts. When a casting is being designed, it is important that these men should be consulted freely, so that non-essential parts of the design may be shaped to suit economical pattern and foundry practice.

Greater Cooperation Desirable Between the Designer and the Patternmaker and Molder

Life is too short for all or even a few designers to take an apprenticeship course in the pattern shop and foundry. Many other manufacturing processes are involved in producing the articles which they design and consistency would dictate an apprenticeship in many other lines besides patternmaking and molding. Such a training being impracticable, dependence must be placed upon the closest possible cooperation and exchange of ideas between the designer and the manufacturing experts.

In the development of fabricated structures, cooperation between the designer and the shop men has been practiced to a large degree. The fabrication of welded structures has been too rapid a development and is too new to have permitted the building up of a brotherhood of welding manufacturing experts, with barriers preventing intercourse and exchange of ideas with what might be considered outsiders—the mere designers of the apparatus. The close cooperation so far existing between designers and shop men in the process of fabricating by the electric arc has been responsible to a large degree for the gigantic strides made in

this method of manufacture. The competition offered by the welding method of manufacture will bring about the greater cooperation and exchange of ideas that is needed between pattern and foundry men, on the one hand, and the designers of cast structures, on the other.

How Welding has Influenced Casting Costs

Among the many advantages derived from welding is the effect it has had on reducing the cost of castings. Fabrication by welding has influenced the cost of castings in three different ways:

1. By simplifying the design. It is difficult to obtain in a welded structure many of the fancy bosses, smooth round corners, curved surfaces, and similar refinements that designers have from time immemorial considered it their right to exact from the foundries. In making substitute welded structures, it has been found that many of these things can be dispensed with, and that very often a casting duplicating the welded-steel substitute would be considerably cheaper than the original casting—perhaps even cheaper than the welded structure.

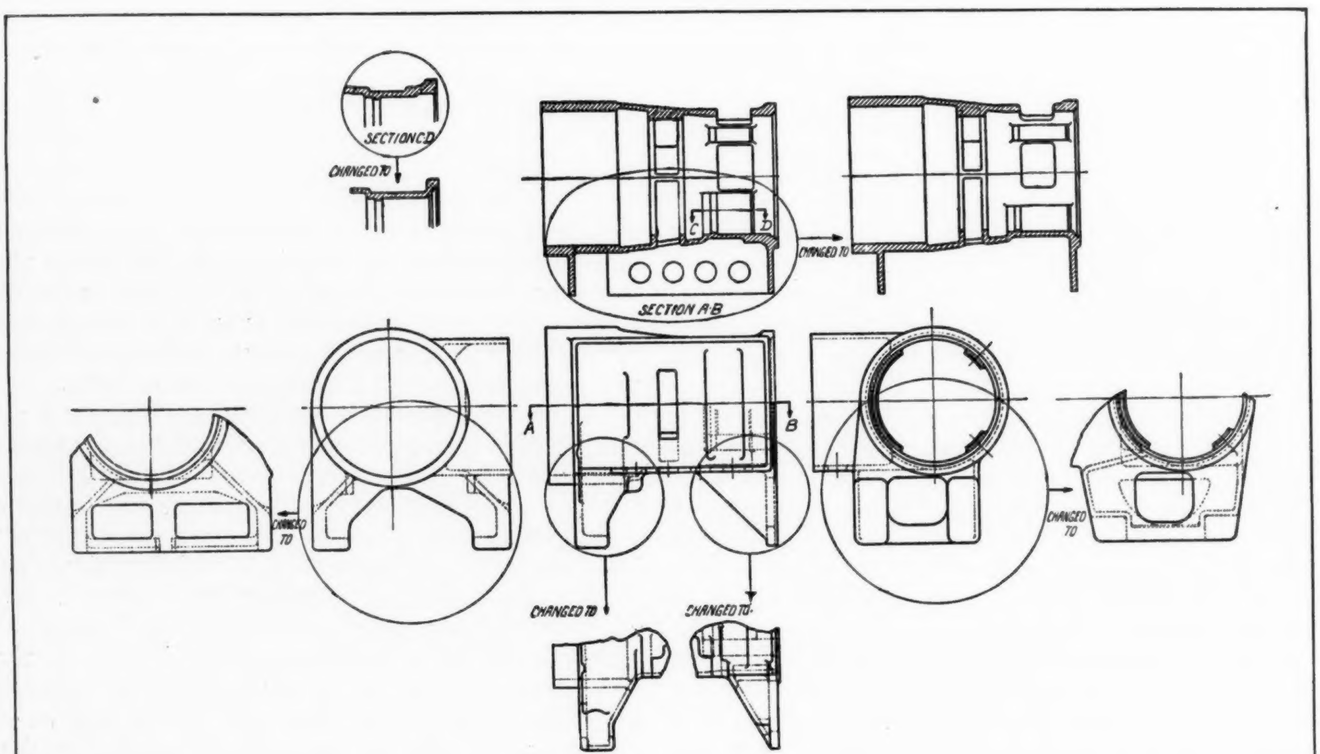
2. By drawing attention to the fact that the real cost of a cast structure, especially when a single piece or a small number of pieces is required, is the cost not only of making the mold and of furnishing and pouring the metal, but of a proportionate part of the labor and material involved in producing the pattern. Patterns can be so made that the metal cast will be used most efficiently to obtain the required strength without surplus metal. For a single casting, a lump of metal approximately the shape of the required part may be produced by using a pattern of very low cost. Even though the part may be of considerable excess weight, the total cost, including the pattern, may be only a fraction of the cost of a part one-half the weight, made by an elaborate pattern. This point is emphasized by the illustrations in Fig. 3.

3. By setting up a total competitive cost. The welded structure compels a careful analysis of foundry practice and casting design, with a view to obtaining the lowest possible casting cost.

Advantages Derived by Substituting Welded Structures for Castings

In substituting welded structures for castings, it must be borne in mind that the most economical welded design may be totally unlike the corresponding casting in physical shape and appearance. Since welded structures consist essentially of rolled-steel members joined together by a welded bead or seam, they are characterized by the peculiarities of rolled-steel sections which, except when rolled into cylinders or otherwise formed, present a distinctly

Fig. 2. The Changes in Design Indicated on this Drawing Reduced the Cost of Making the Casting More than 50 Per Cent



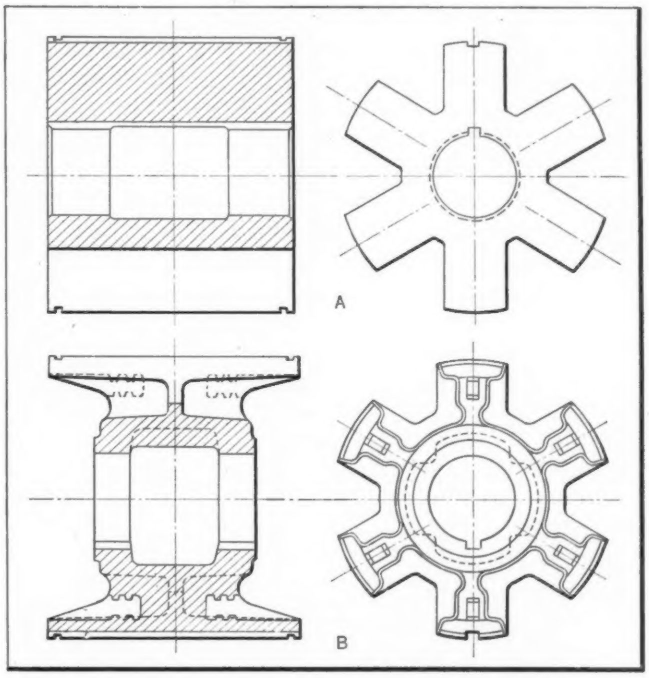


Fig. 3. (A) Cast Spider that is of Excess Weight, but is Made from a Cheap Pattern; (B) Spider of Minimum Weight, but Requiring an Expensive Pattern

angular appearance, with flat surfaces and sharp corners prevailing.

On the other hand, the designer of welded structures is not handicapped by the necessity of designing sections so as to facilitate the flow of molten metal, to resist shinkage stresses encountered in solidification, and to provide, as in the case of malleable iron castings, proper conditions for the annealing process. Welded structures, also, need no supporting cores or provisions for shrinkage, nor schemes for withdrawing the pattern from the mold.

Thus, welding unshackles the designer from many bonds of casting etiquette and opens a large new field of possibilities. Hollow-column construction, which is ideal for torsional members and is largely denied the casting designer, becomes simplicity itself in welded designs. Closed-box designs which introduce difficult core-supporting problems in making castings are likewise fabricated simply.

The Characteristics of Castings and Rolled Steel

Welded structures may be considered as substitutes for castings of various materials that have been chosen to meet certain conditions. Gray iron castings are commonly employed where stresses are relatively low, either because the forces are small or the section of the material is ample, and where ease of machining is a factor. Malleable iron castings are employed for comparatively light work when freedom from brittleness is important; they can also be used in cases where steel castings could be made only with difficulty, on account of the thin sections used, or where steel castings would be stronger and more expensive than is necessary for the required purpose.

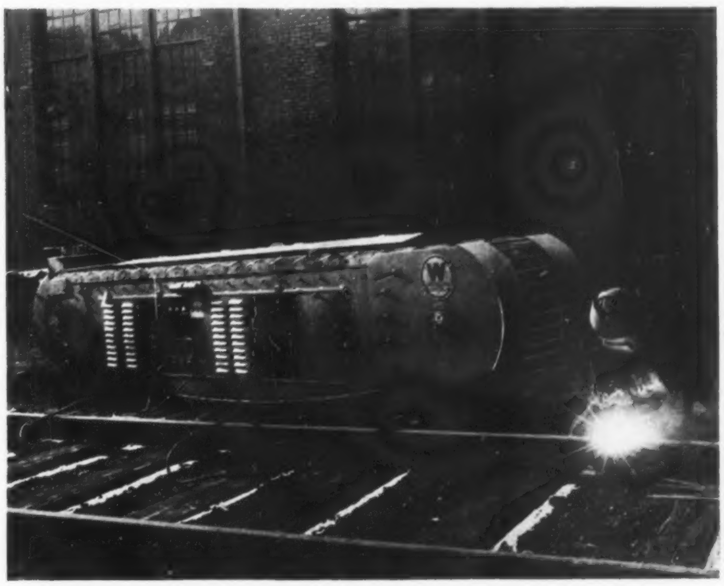
Semi-steel castings are employed when greater strength is required, but not the strength of steel. Tolerably good magnetic characteristics are obtainable with semi-steel castings and the characteristic "cast iron" texture is advantageous for machining purposes or for use as a wearing surface on brake-drums, etc. Steel castings are used chiefly for highly stressed parts, for parts subjected to shock loading, and for parts in which a magnetic material of high permeability is required.

The welded-steel substitute must compete with the corresponding cast design in the cost of the structure itself, in the cost of machining, and in fulfilling the required functions of the finished product. Rolled steel competes successfully with all four cast materials mentioned in magnetic qualities, strength, and ductility. It can be machined as easily as cast steel and is equally satisfactory as a bearing or braking surface, but it is somewhat at a disadvantage in these two respects as compared with gray cast iron, malleable iron, and semi-steel.

Conditions Favorable to Welded Structures

Of increasing importance in present-day manufacturing is the problem of "short deliveries." The

Fig. 4. The Frame of this Caterpillar Welder is Representative of Many Cases where a Welded Structure is More Advantageous than a Cast Construction



request for immediate delivery of non-stocked parts sometimes places almost impossible demands upon the production department. Perhaps the machining department must await the arrival of a casting from a distant foundry. Its arrival may be delayed by the necessity of making a pattern; certainly by the time required for preparing the mold, pouring the metal, cooling the casting in the sand to prevent shrinkage cracks, shaking out, removing gates and risers, tumbling, and sand-blasting; and possibly annealing. Occasionally, the first casting is a failure, causing further delay. Often, therefore, the delivery date specified for a product dictates a welded design, regardless of cost.

In cases of this kind, the number of pieces required is usually small, which is another point in favor of the welded design. Castings are most advantageous when elaborate and expensive patternmaking and molding equipment may be used in their production. When only a small number of pieces is required, the cost of elaborate equipment is not justified, as the cost per casting becomes too high. A proportionate part of the pattern cost must be added to the cost of each casting, thus setting up a total cost figure that is likely to be higher than the cost of a welded design. When quantities are large enough to justify elaborate patternmaking and molding equipment, greater skill will be required to design a welded structure that will compete successfully with the casting, especially if cast iron has ample strength for the purpose intended and, due to its ready machineability, can be finished in automatic machines.

Fig. 5. Motor-frame Castings Such as Shown are not Easily Replaced by Satisfactory Welded-steel Structures

Large-size castings require patterns that may cost as much as the completed fabricated structure itself. The mold for such a casting requires much time in its preparation, demands great skill to insure success, and involves the hazard of an explosion when the metal is being poured, if moisture exists. Failure to secure a successful casting results in loss of money and, of course, delay. An error in a fabricated structure, on the other hand, is readily repaired with little delay by burning out the defective part and welding in a new piece. The accumulation of large, or even medium-sized, infrequently used patterns presents a serious storage problem, which automatically vanishes with the substitution of welded-steel designs.

Welded structures of intricate shape, necessitating the use of many pieces of steel and much welding as compared with the weight of the material, particularly if the welds are difficult of access, may prove to be far more expensive than a casting. This is especially true if cast iron is strong enough for the intended use. Approximately spherical surfaces are difficult to produce in fabricated structures without the use of special forming tools. On the other hand, as already mentioned, hollow-column and closed-box designs, which are intricate to cast, are fabricated with ease. Many machine parts previously produced as castings have failed under repeated stresses and have been replaced cheaply, without the expense of restoring the pattern, by a lighter and stronger part of welded steel.

Casting and welding should not be considered as manufacturing processes that are competitive only. One of the greatest uses of the electric arc is to aid the foundryman. Not only is it indispensable in the salvage of castings, but there is undoubtedly a great field for the development of designs in which these two methods of construction are complementary, each contributing its peculiar advantages to the efficiency of the finished structure as a whole.

* * *

Southwark Builds Heavy Press for Making Dry Ice

A recent development of the Baldwin-Southwark Corporation, Philadelphia, Pa., is a heavy hydraulic press for the manufacture of solid carbon dioxide, commonly known as "dry ice." In making dry ice, very high pressures are required, since only by heavy compression can the "snow" be induced to remain in solid form for any length of time at atmospheric pressure and normal temperature.

The Effect of Alloying Metals on Gear Steels

A Brief Review of the Properties Imparted to Steel by the Metals Commonly Used in the So-Called Alloy Steels

WHEN it is deemed necessary to use a heat-treated alloy steel for gears, in order to obtain superior characteristics or properties, as compared with heat-treated plain carbon steels, the selection of the alloying element or elements to use is difficult. Some of the elements have similar effects, some have overlapping qualities, and others introduce quite opposing conditions. Compromise is necessary, but the choice, due to the overlapping qualities, is, to some extent, often a matter of personal opinion.

In a paper read before the eighteenth annual meeting of the American Gear Manufacturers' Association at Wilkinsburg, Pa., T. R. Rideout of the Westinghouse Electric & Mfg. Co., outlined what properties are expected in steels for gears (see MACHINERY, August, 1934, page 739). In this paper, the author also concisely summarized the effect of the various alloying elements on steel, in order to assist engineers in deciding upon the particular kind of alloy steel to use for specific purposes. The characteristics, as outlined in the following, apply only to heat-treated steels. When the effect of the addition of an alloying element is stated, it is understood that reference is made to alloy steels of a given carbon content, compared with a plain carbon steel of the same carbon content.

Nickel—The addition of nickel tends to increase the hardness and strength, with but little sacrifice of ductility. The hardness penetration is somewhat greater than that of plain carbon steels. Its use as an alloying element lowers the critical points and produces less distortion, due to the lower quenching temperature. The nickel steels of the casehardening group carburize more slowly, but the grain growth is less.

Chromium—Chromium increases the hardness and strength over that obtained by the use of nickel, though the loss of ductility is greater. Chromium refines the grain and imparts a greater depth of hardness. Chromium steels have a high degree of wear resistance and are easily machined in spite of the fine grain.

Manganese—When present in sufficient amounts to warrant the use of the term alloy, the addition of manganese is very effective. It gives greater strength than nickel, and a higher degree of toughness than chromium. Owing to its susceptibility to cold-working, it is likely to flow under severe unit pressures. Up to the present time, it has never been used to any great extent for heat-treated gears, but is now receiving an increasing amount of attention.

Vanadium—Vanadium has a similar effect to that of manganese—increasing the hardness, strength, and toughness. The loss of ductility is somewhat more than that due to manganese, but the hardness penetration is greater than for any of the other alloying elements. Owing to the extremely fine-grained structure, the impact strength is high; but vanadium tends to make machining difficult.

Molybdenum—Molybdenum has the property of increasing the strength without affecting the ductility. For the same hardness, steels containing molybdenum are more ductile than any other alloy steels, and having nearly the same strength, are tougher; in spite of the increased toughness, the presence of molybdenum does not make machining more difficult. In fact, such steels can be machined at a higher hardness than any of the other alloy steels. The impact strength is nearly as great as that of the vanadium steels.

Chrome-Nickel Steels—The combination of the two alloying elements chromium and nickel adds the beneficial qualities of both. The high degree of ductility present in nickel steels is complemented by the high strength, finer grain size, deep hardening and wear-resistant properties imparted by the addition of chromium. The increased toughness makes these steels more difficult to machine than the plain carbon steels, and they are more difficult to heat-treat. The distortion increases with the amount of chromium and nickel.

Chrome-Vanadium Steels—Chrome-vanadium steels have practically the same tensile properties as the chrome-nickel steels, but the hardening power, impact strength, and wear resistance are increased by the finer grain size. They are difficult to machine and become distorted more easily than the other alloy steels.

Chrome-Molybdenum Steels—This group has the same qualities as the straight molybdenum steels, but the hardening depth and wear resistance are increased by the addition of chromium. This steel is very easily heat-treated and machined.

Nickel-Molybdenum Steels—Nickel-molybdenum steels have qualities similar to chrome-molybdenum steel. The toughness is said to be greater, but the steel is somewhat more difficult to machine.

Engineering News Flashes

The World Over

Five Billion Revolutions and Still Running

With nearly five billion revolutions to its credit, a fan located on the roof of the General Electric Co.'s Pittsfield Works completed, this summer, its fifth year of continuous operation in a life test "to destruction." The fan, one of a type built to cool the coils of power transformers, is still running, with engineers checking it at frequent intervals, waiting for the time it will wear itself out. Thus far, however, they have observed no indication that the fan, which is similar to those used in homes and offices, has reached the limit of its endurance.

Because the fans used in power transformers are subjected to severe service conditions, the five-year fan was placed on the roof of the building, exposed to all kinds of weather, year in and year out. It has been running with blizzards howling around it, it has kept on going in the midst of driving rains and in sleet storms, and has kept its even pace at 40 degrees below zero and at 100 degrees above.

World's Largest Under-Water Tunnel

What is considered one of the greatest feats of engineering during recent years—the Mersey Tunnel—has just been opened. This is a vehicular tunnel under the Mersey River, connecting Liverpool with Birkenhead. Its total length is slightly over two miles. The width of the roadway is 36 feet, and the total diameter of the tube forming the tunnel is over 46 feet. Differing from the arrangement in the Holland Tunnel under the Hudson River between New York and Jersey City, where two tubes are used—one for traffic in each direction—the Mersey Tunnel has a single tube wide enough for traffic in both directions, allowing for two lanes each way, or four lanes in all.

France Builds Light-Weight, High-Speed Trains

A new Diesel electric unit-train is being tried out in France on the route from Molsheim to Strasbourg. The new train consists of two cars having a carrying capacity of 165 passengers. It is rated at 800 horsepower and is capable of running at speeds up to 125 miles an hour. The train was built for the Paris, Lyons, Mediterranean Railway and will be placed in regular service on the line from Paris to Vichy. It is also planned to put one of these trains in service between Paris and Nice. Running at a speed of 93 miles an hour, Nice will be but seven hours distant from Paris—about half the time now required.

Air Trains—A New Soviet Idea

The world's first "air train" recently completed a thousand-mile journey from Moscow to Koktobel in the Crimea. The train consisted of an airplane with three gliders in tow. The flight was intended to prove the feasibility of this means of distributing mails. The gliders are detached at intermediate points, the plane proceeding without landing. The idea has since been taken up in this country.

British Railroads Claim Speed Records

A recent issue of *Industrial Britain* claims three railroad speed records for Great Britain: First, the world's highest authentic rail speed with a regular railroad train, at the rate of 102.3 miles per hour, made by the Plymouth Ocean Mail Express; second, the world's fastest regular train run—that of the Cheltenham Flyer, which has a stop-to-stop speed of 71.3 miles an hour; and third, the world's longest regular non-stop run, which is made by the Flying Scotsman from London to Edinburgh, a distance of 392 miles. British railroads also make a feature of fast freight trains running at night. There are regularly scheduled 370 nightly freight express trains between the larger centers in Great Britain, which deliver freight loaded at night to its destination the next morning.

Immense Russian Steel Plant

Up to the beginning of this year approximately $300,000,000 has been invested in the construction of the Soviet Magnitogorsk steel mill. Over a hundred million dollars more will be expended on this plant, of which $20,000,000 will be applied to housing construction and club buildings. It is expected that this year the plant will turn out 1,300,000 tons of pig iron, 550,000 tons of steel ingots, and 100,000 tons of rolled shapes.

Using Coal Gas for Automobiles

A new fuel for automotive vehicles is being used in England. The Wallasey Municipal Gas Works are now installing a plant to supply compressed gas for motor-vehicle fuel. Gas under a pressure of 3000 pounds per square inch is contained in steel cylinders weighing 112 pounds. These cylinders are constructed to be attached to motor vehicles. Each one contains gas sufficient for a 20-mile drive. The usual equipment will be four cylinders per vehicle. It would seem as if this equipment might be most suitable for trucks.

A Device that Picks out Noises in Machinery

A portable noise analyzer intended for commercial use has been developed by the research laboratories of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. This analyzer equals the sensitivity of the best types of laboratory analyzers, and yet is so rugged that it can be carried about and used almost anywhere.

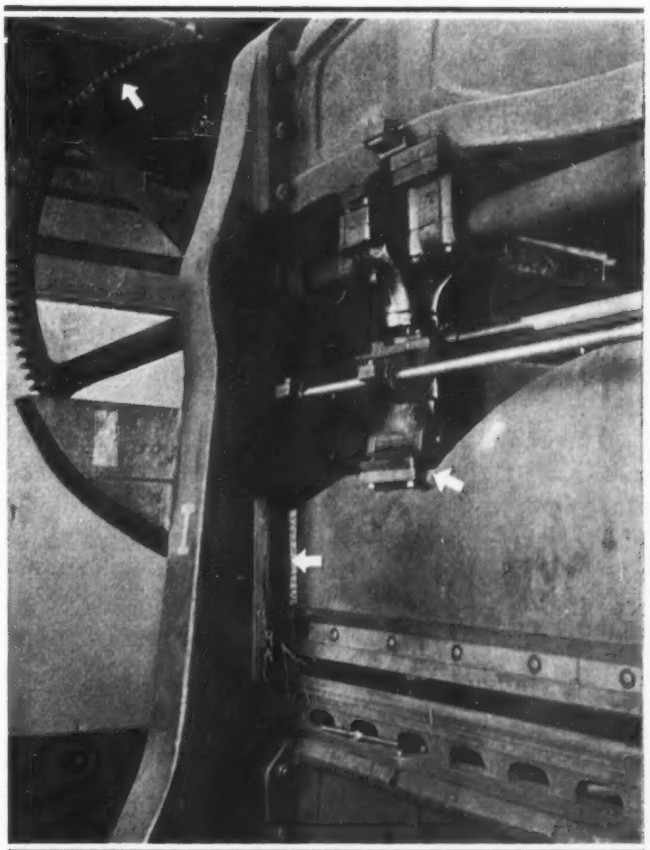
This analyzer should not be confused with the ordinary noise meters, which measure only the intensity or loudness of a noise, since the analyzer separates the noise into its different elements and will measure the pitch and intensity of each component. For example, the noise analyzer has been of material assistance in reducing the noise of electric motors. It is possible to find out how much of the total noise is caused by the unbalance of the rotor, how much is caused by the commutator bars, and what part is due to gear noises. It also enables the engineer to trace the causes of the noise so that it can be eliminated at its source. The analyzer has already played an important part in providing for quiet electric refrigerators, vacuum cleaners, and other household appliances.

2200 Railway Cars Air-Conditioned

More than 2200 passenger cars are being equipped with air-conditioning apparatus this year on American railroads. This is one of the most outstanding developments in modern transportation. Both sleeping cars, day passenger cars, and dining cars are being equipped so that one may travel in comfort at moderate room temperature, no matter what the heat is outside. At the end of 1933, there were 648 air-conditioned cars in service on American railroads.

Quantity Production of Steel Houses

A new type of fabricated house made entirely of steel is being constructed in England on a mass production basis. The construction is insulated on the principle of the thermos bottle. It is stated that two workers can erect a house having four rooms and bath, complete with doors and windows, in sixteen hours.



A Broken Cast-iron Ram on a 10-foot Bending Brake at the Plant of the Thornton Co., Cleveland, Ohio, was Recently Repaired and the Machine Put Back in Operation within Forty-eight Hours, When New Castings Could Not Have Been Obtained in Less Than Two Months. As a Result, an Important Contract was Filled on Time. The Ram, Nearly 6 Inches Thick, was Arc-welded with Lincoln Equipment, as Indicated by the Arrows. The Break in the Cast-iron Gear Repaired Five Years Ago by Arc Welding at the Point Indicated by the Upper Arrow, and the Recent Break in the Ram Were Repaired at a Fraction of the Cost of New Parts.

EDITORIAL COMMENT

Arc-Welded Fixtures Prove Economical for Small-Lot Production

Radical changes in the methods of making jigs and fixtures have been introduced in many plants by the use of the arc-welding process. Usually only one fixture of a certain design is required, and the making of a pattern for a single casting for the frame of the fixture adds greatly to the expense.

The arc-welding process, by means of which the fixture is built up from steel plates and structural shapes, not only reduces the cost greatly, but often makes it possible to build the entire fixture in the time required for making the pattern alone; and frequently the cost of the welded fixture body is less than the cost of the pattern, thus saving the entire cost of the foundry work.

There is still another advantage derived through the use of welded jigs and fixtures. Because of the low cost of arc-welded equipment, it is frequently economical to build jigs and fixtures for small-lot production, whereas with cast fixtures, the cost of the casting would make the fixture-cost prohibitive, unless the production were large enough to warrant the expense. Some of the larger concerns have made a careful study of the possibilities of welded jig and fixture equipment and have developed definite design methods and technique for the economical application of the welding process to this work.

A New Industry Creates a Demand for a New Type of Machine Tool

"Hundreds of thousands of parts are produced daily from bars and shapes of synthetic plastics by machine tools that are designed for metal cutting. I believe that costs could be greatly reduced if we had machine tools designed specifically to meet the needs of the synthetic plastics industry." This statement was made by the chief executive of one of the large companies engaged in the manufacture of synthetic plastics, who, himself, was a dealer in machine tools for many years, and who is, therefore, thoroughly acquainted with shop equipment.

This executive believes that there is a great opportunity for one or more machine tool builders to study the requirements of the synthetic plastics industry and provide equipment of the character needed in this field—equipment, generally speaking, that may be lighter and cheaper than the standard metal-cutting machines, but that should provide higher speeds.

"I had to go to a manufacturer of dental equipment," he continued, "to buy an abrasive-wheel cutting-off machine to meet the needs of my industry." He went on to say that there is also a great opportunity in the manufacture of perishable tools that are used in large quantities. The big concerns that specialize in such tools for metal cutting could doubtless add a profitable side line in tools suitable for synthetic plastics.

The market for machines and tools suited to this new industry is a growing one. There are now several plants that have hundreds of employes engaged solely in the production of synthetic plastic parts from bar stock; and there will be more such plants in the future. These plants use automatic screw machines, lathes, drilling machines, band saws, cutting-off machines, and polishing machines; but the machines they now use were built for metal and do not give the most suitable feeds and speeds for plastic materials. They are unnecessarily heavy, and are provided with many features not needed in the synthetic plastic field.

Doubtless the new needs of this new industry will be filled by the machine tool builder as soon as it is apparent that there is an adequate market for this new type of equipment.

Whither Engineering? Inevitably toward public service—toward the ideal that the engineer is a public official, charged first with a public function, as a lawyer is an officer of the court, responsible for its dignity and honor. Inevitably toward a wider responsibility—toward the ideal that he is responsible for maintaining that balance in the social structure which modern conditions have sometimes so violently upset. Inevitably toward active participation in political affairs where clear thinking and courageous action are badly needed. Inevitably toward a higher type of education.—*A. A. Potter, Dean of Engineering, Purdue University; Past-President, A.S.M.E.*

Ingenious Mechanical Movements

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and Other Devices

Link Mechanism for Obtaining Dwell in Lever Movement

By PAUL GRODZINSKI

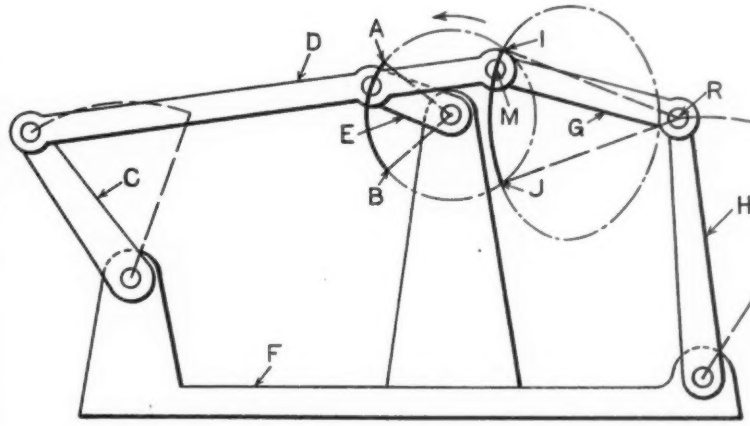
Several multiple lever mechanisms designed to obtain dwells in lever movements were described in April MACHINERY, page 467. The accompanying illustration shows crank-driven mechanisms which also provide lever movements having a dwell period. The view at the right shows a design applied to a textile machine which provides a dwell period for the lever *K* equal to nearly one-third the period required for a complete revolution of the crank-arm *L*. This mechanism is used on a weaving loom built by the firm Oscar Moeschler, Meerane, Saxonia, and has proved very successful. The pause or dwell obtained with this arrangement is of sufficient duration to permit the shuttle to pass from one side of the machine to the other.

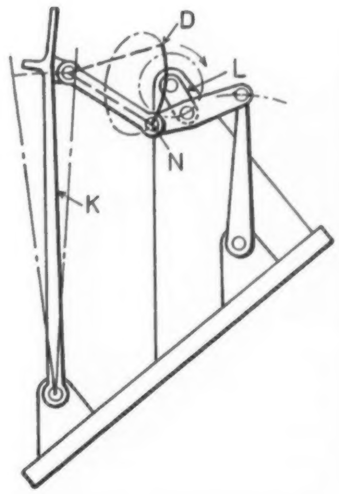
Referring to the view at the left, which shows the principle of operation, it will be noted that the driving arm *E*, which revolves continuously in the direction indicated by the arrow, is connected to rod or link *D* at a point approximately one-fourth its length from the end connected to link *G* by the stud *M*. Link *G*, in turn, is connected with the upper end of the driven lever *H*, which oscillates through the arc *RS*, dwelling at *R* while the stud *M* travels from *J* to *I*. The lever or arm *C*, connected to the left-hand end of link *D*, also oscillates through an arc as indicated. The amount of dwell and the length of the arc through which the driven lever oscillates depends, of course, on the positioning and the lengths of the links and levers. The use of slide ways for varying the relative positions of the links may be advantageous in some of the many applications for which a mechanism of this kind is adapted.

Mechanism for Producing Spherical-Elliptical Movement

By E. K. LLOYD

Many of the sewing machines used in manufacturing clothing, bags, awnings, etc., use what is commonly known as a double lock stitch. These machines have two needles operating at right angles to each other. The lower needle operates beneath the throat plate that supports the goods being stitched. This needle is commonly termed a "looper," as it does not pierce the goods, but passes into and out of the loop of thread made by the other needle in its vertical motions. The loop of thread is



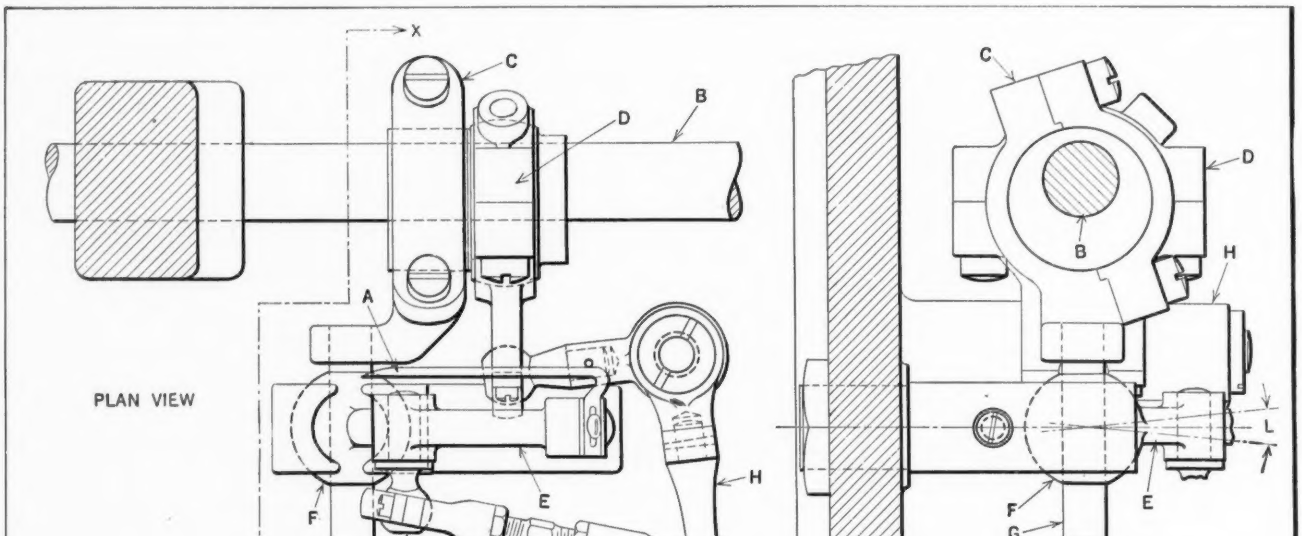


(Left) Mechanism in which the Link H Dwells while the Crankpin of the Driving Arm E Travels from A to B. (Right) Application of Mechanism Shown at Left to a Textile Machine

formed at the desired location below the throat plate during the upward motion of the needle by permitting the thread to become slack at the proper time, thus causing it to buckle and form the loop. A mechanism used to impart the required motion to the lower needle, or looper, is shown in the accompanying illustration.

The looper *A* is required to pass very close to the needle in taking up the loop of thread. It must hold this thread loop and position itself on the opposite side of the needle's path by the time the needle has descended below the throat plate in forming the next stitch. From this it is apparent that the looper must have a back-and-forth motion at right angles to the needle and at right angles to the direction in which the goods travels. In addition, the looper must have a back-and-forth motion at right angles to the needle in the line of travel of the goods being stitched. This latter motion is commonly called the "avoider" motion, since its object is to avoid or prevent interference with the needle. The path followed by any point on the looper *A* consists of a closed curve that resembles an ellipse bent to fit the surface of a sphere.

The main shaft *B* carries the flat strap eccentric *C* and the ball-joint eccentric *D*, which drive the rocker arm *E*, mounted in the spherical bearing *F*. Arm *E* carries the looper *A*. Eccentric *C* imparts motion to arm *E* by means of pin *G*, which passes through the center of bearing *F* with which it is in sliding engagement. This gives the looper *A* an oscillating movement within the limits of travel indicated by angle *L* in the section view. Eccentric *D*, by means of its connection with the ball-ended bell-



Mechanism in which Ball Joints, Links, and Levers Operated by Two Eccentrics are Used to Obtain Spherical-elliptical Movement of Member A

crank H and link J, causes arm E to oscillate about the center of pin G, so that A moves back and forth between the positions shown by the full lines and by the dotted lines at M.

It will be noted that eccentrics C and D impart motions to A which are approximately at right angles to each other, in producing the spherical-elliptical movement. Eccentric C gives the needle the "avoider" motion, while eccentric D imparts the motion that causes the looper to pass in and out of the thread loop formed by the needle that pierces the goods.

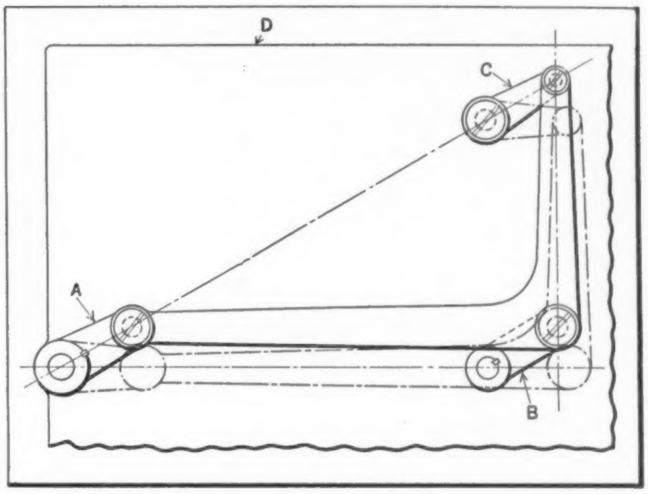
Considering the action of eccentric C in producing the "avoider" motion, it will be noted that only one component of the circular motion of this eccentric imparts motion to the looper, the other component resulting in pin G sliding through the ball joint in F. With reference to eccentric D, it will also be noted that only one component of this circular motion is imparted to looper A through its connection thereto by means of bellcrank H, link J, ball-pin K, and rocker arm E, whereas the other component of this motion causes rotation about its connection with the bellcrank H. Thus the motion imparted to the looper A may be considered as being the resultant of two circular motions at right angles to each other. The relative values of these two motions have been changed by means of levers, in order to give to each the desired amplitude.

The motion described could be obtained from a single eccentric, except for the mechanical difficulties encountered in obtaining suitable proportions for the components required for such motion. The motion produced by the mechanism illustrated is the resultant of two simple harmonic motions at right angles to each other, each being modified by the length and angularity of the connecting links. It is believed that this form of looper drive is well adapted to high speeds, since it is relatively simple, has few parts, and the few rapidly moving parts required can be made quite light. There are no violent changes in velocity, and the energy changes and friction losses are thus kept at a minimum.

"Dummy" Crank that Assists Crankpin Past its Dead Center

By J. E. FENNO

One method of overcoming the dead center condition in transmitting rotary movement to a shaft by means of a crank is shown in the illustration. Two of the outstanding advantages of this drive are its positive action and its low cost. The driven crank is actuated by a similar crank keyed to the driving shaft. By incorporating a "dummy" crank, the driven crankpin not only is helped past its dead center positions, but the angular velocity of the driving and driven shafts is held constant. In addition to this, the torque transmitted to the driven shaft is uniform at its various angular positions.



Arrangement for Preventing Crankpin from being Stopped on Dead Center

The shaft-to-pin center distance is the same for all three cranks. The driving crank is indicated at A, the driven crank at B, and the "dummy" crank at C. It is important to note that the connecting-rod is of solid construction and connects all three crankpins. With this arrangement, the position of all three cranks is the same at any part of the machine cycle.

In the full outline, the cranks and connecting-rod are approaching the dead center position. When they reach this position, they will coincide with the dot-and-dash outline. Here it is obvious that the crankpin in the "dummy" crank has passed its dead center and can continue its movement unrestricted. Now, owing to the rotary action of crank A, crank C will swing downward, and as a result, crank B will be forced past its dead center. The same action occurs in reverse order when crank C is on its dead center relative to crank A. That is, crank B, having passed its dead center, will serve to force crank C past its dead center position. Incidentally, the location of crank C can be varied to suit existing conditions, although it should not be located too close to a straight line passing through the driving and driven shafts.

* * *

Lubricating Delicate Machinery

According to the Acheson Oildag Co., in lubricating fine mechanisms, such, for example, as automatic telephone equipment or similar high-grade devices, the lubricant should be made to cover all bearing surfaces very lightly. For covering large surfaces, such as ratchets, a No. 1 sable or camel's hair brush should be used. For small surfaces, a finely pointed stick or toothpick is preferable. After the various parts have been lubricated, they should be operated a few times in order to "work in" the lubricant, after which all surplus lubricant should be wiped off.

One Piece Every Three and a Half Seconds

Fig. 1. These Ball-bearing Cones are Made Complete and Burnished in Three and a Half Seconds in an Automatic Screw Machine

Ball-bearing cones of the type shown in Fig. 1 are produced in an automatic screw machine at the rate of 1028 pieces an hour, or one every three and a half seconds. The part is about 9/16 inch outside diameter by 13/16 inch long, and is used in roller skates. The machine in which this part is made is a four-spindle 7/8-inch Gridley automatic, built and tooled up by the National Acme Co., Cleveland, Ohio.

One of the special features of this operation is that the race surface is burnished, eliminating a previous separate grinding operation, and thus effecting a considerable economy. In the first operation in the screw machine, which is performed at the lower rear station of the spindle carrier, tools on the main slide spot-drill and face the end of the bar stock at the same time that a tool on the lower rear cross-slide forms the piece. This operation is illustrated in the top sketch of Fig. 2.

The second operation is performed at the lower front station of the spindle carrier, the part being drilled one-half its length by a 1/4-inch drill, driven by a high-speed attachment which is mounted on the main slide. At the same time, the part is finish-formed by a shaving tool on the lower front cross-slide. A roller rest firmly backs up the part at two points during the shaving cut.

In the third operation, the part is burnished at the upper front station of the spindle carrier by a roller mounted on the top cross-slide. The burnishing tool is set to bear on the revolving part with sufficient force to compress the surface of the metal and thus produce the high finish desired. A roller rest also backs up the part at two points for this operation, as illustrated in the third sketch of Fig. 2. While the burnishing is being done, a drill in another high-speed attachment mounted on the main slide completes the 1/4-inch hole that extends through the part.

The final operation is done at the upper rear station of the spindle carrier. It consists of reaming the hole in the part with a tool mounted in an independent reaming spindle on the main slide and of cutting off the part from the bar stock with a tool mounted on the rear top cross-slide. The two high-speed drilling attachments are driven by a gear on the end of the spindle-carrier stem.

These ball-bearing cones are produced from 9/16-inch free-cutting high-sulphur screw stock. The work-spindles run at a speed of 1547 revolutions per minute, giving a surface speed of 224 feet per minute. The feed for drilling is 0.005 inch per spindle revolution, and for reaming, 0.0075 inch. The use of a disappearing stock stop enables this part to be produced complete in a four-spindle machine. The operations described are an excellent example of the speed with which small parts can be produced in the modern type of automatic machines.

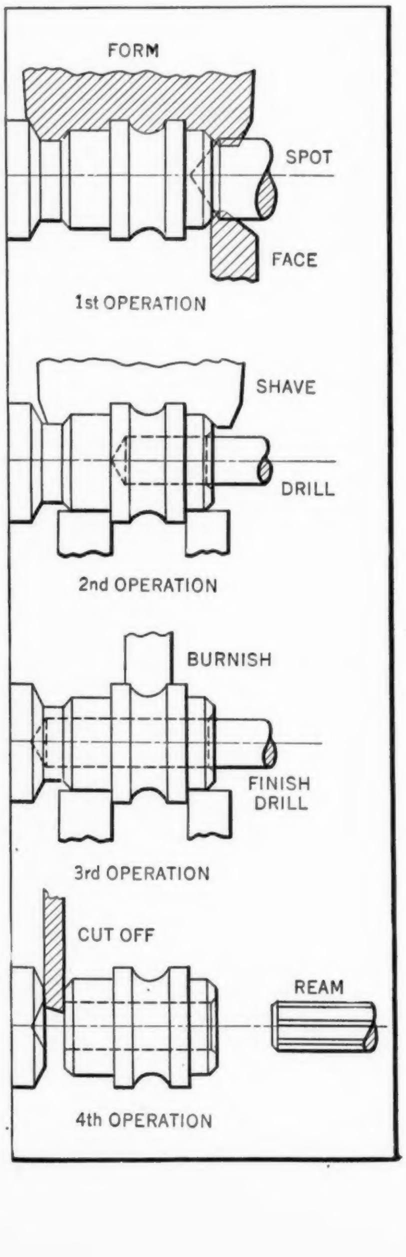
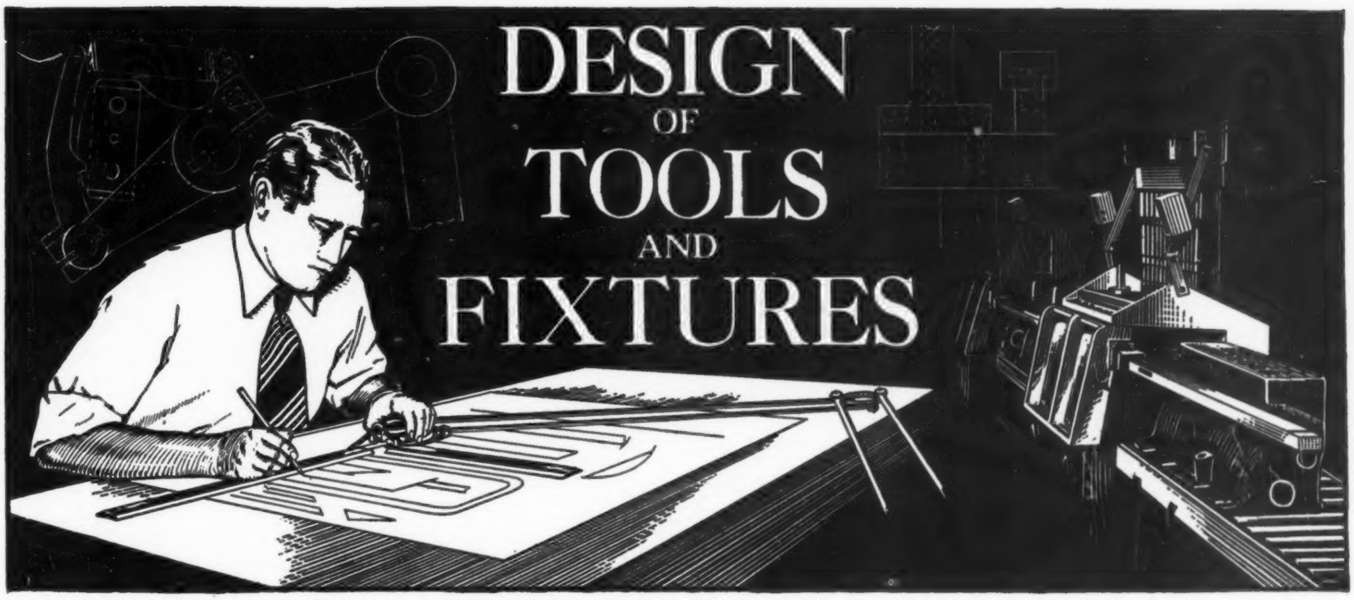


Fig. 2. Sequence of Screw Machine Operations on the Ball-bearing Cones Illustrated in Fig. 1

* * *

Minute Explosions Produce Aluminum Paint

By exploding the powder lumps that are bound to form during the processing of aluminum paint, the Aluminum Industries, Inc., of Cincinnati, Ohio, have developed a new aluminum paint that is said to spread better than paint of this kind previously produced. The principle involved in the new process is best illustrated by comparing ready-mixed paint to housewives' batter. When flour is mixed with water, particles of the flour form small lumps. It is virtually impossible to break up the smallest of these lumps by ordinary mixing methods. Aluminum-bronze powder particles, like flour, tend to group together in clusters; but by applying a high vacuum in the processing of the paint, the air imprisoned within the lump is released with an explosive effect. It is stated that aluminum paint so made gives more thorough coverage and better protection, as well as a smoother surface, and that it promises to be widely used.

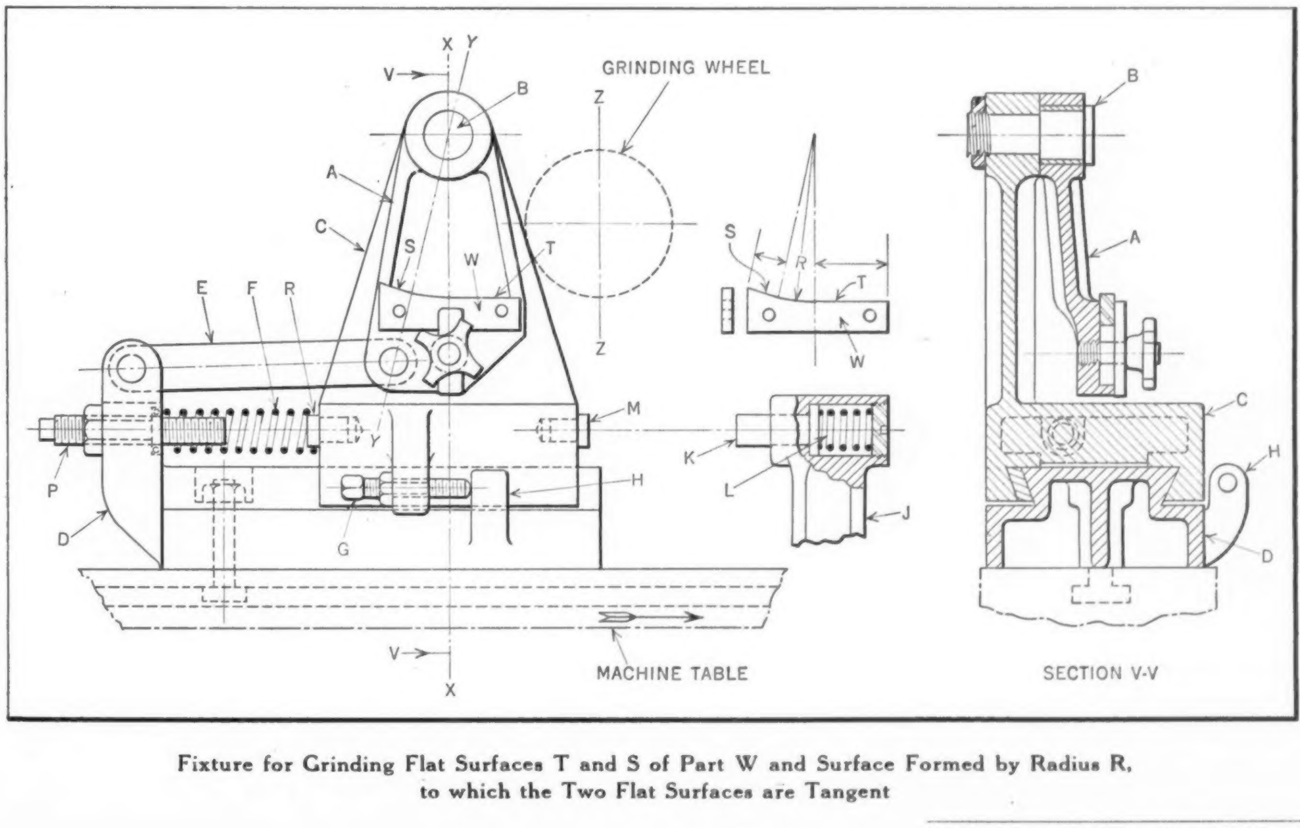


Fixture for Grinding Two Flat Surfaces Tangent to a Radius-Formed Surface

The fixture shown in the accompanying illustration provides a means for accurately grinding the upper face of part *W*. The portion to be ground consists of two flat surfaces *S* and *T*, which are tangent to the connecting surface formed by radius *R*. The work is located on and clamped to arm *A*, which pivots on pin *B* when grinding the radius-formed surface. The slide *C*, which supports arm *A* through pin *B*, slides on the base *D*, mounted on the table of the grinding machine. The link *E* connects arm *A* and base *D*.

The spring *F*, acting between base *D* and slide *C*, normally keeps the adjusting screw *G* of slide *C* in contact with lug *H*, so that arm *A* is held in the position shown. Bracket *J*, containing plunger *K* and spring *L*, is attached to the machine frame—not shown. In operation, the machine table is moved to the right until center line *X–X* of the fixture coincides with center line *Z–Z* of the grinding wheel. This completes the grinding of the flat surface *T* and brings the stop *M* into contact with plunger *K*, which limits further travel of slide *C*, while base *D* continues to move forward.

Since spring *L* is stiffer than spring *F*, the latter spring is compressed until the adjusting screw *P*



Fixture for Grinding Flat Surfaces T and S of Part W and Surface Formed by Radius R, to which the Two Flat Surfaces are Tangent

comes in contact with stop *R*. While the spring *F* is being compressed, base *D*, acting through link *E*, causes arm *A* to pivot on pin *B*, so that the arc-formed surface is ground to the required radius *R*.

This arc-grinding movement is completed when the adjusting screw *P* and stop *R* come into contact, at which point the flat surface *S* is in the horizontal position, ready for grinding, and the center line *Y–Y* coincides with *X–X*. Further movement of base *D* compresses spring *L*, during which period surface *S* is finished, thus completing the grinding cycle.

The return of the machine table to its initial position reverses the order of the fixture movements. A feature of interest is that the diameter of the grinding wheel has no effect on the ground profile, provided the radius of the wheel is not greater than the radius of the arc to be ground. R. P.

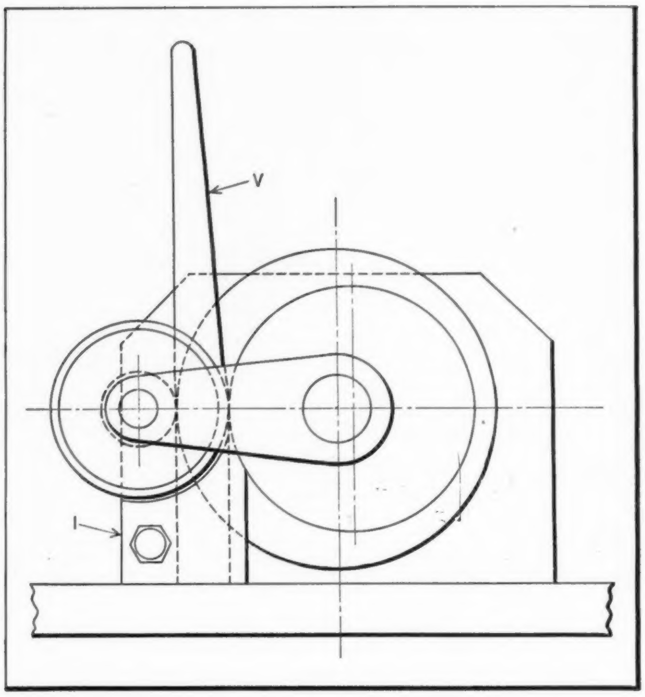


Fig. 2. Fixture Shown in Fig. 1 with Work V in Position for Bending

Punch Press Fixture for Forming Blanks

By H. R. SCHMIDT, Philadelphia, Pa.

In order to economize in the use of material, flat pieces like the one shown at *W*, Fig. 1, were blanked out straight, as shown at *V*, and later bent to shape in the punch press fixture illustrated. In Fig. 1, the bending roller *E* is shown in the position it occupies when about half the working stroke has been completed, while Fig. 2 shows the position of the roller when the ram of the press is up and a blank *V* is in position to be bent.

Referring to Fig. 1, the cast-iron base *A* has an upright *B* cast integral with it. The pinion *C* is actuated by the rack *H*, which is attached to the punch-holder and kept in mesh with the pinion by the guides *K*. To the front end of the pinion shaft is attached the bellcrank *D*, carrying the hardened roller *E*.

The periphery of the hardened forming plate *F* is turned concentric with the hole for the pinion shaft, while the shouldered portion *G* is turned eccentric with it, so as to conform to the taper of the piece to be bent. The space at *J* between the roller *E* and plate *F* conforms to the cross-section of the piece to be bent throughout the stroke of the roller. This prevents the piece from buckling while it is being bent.

The gage *I*, which is slotted to form a continuation of the space between the roller and the forming plate, holds the large end of the piece in place while the tapered end is being bent. In operation, a blank is placed in the space between the roller and the forming plate, and pushed down until it comes to rest against the base, as shown in Fig. 2. The press is tripped and the roller bends the blank around the forming plate by traveling

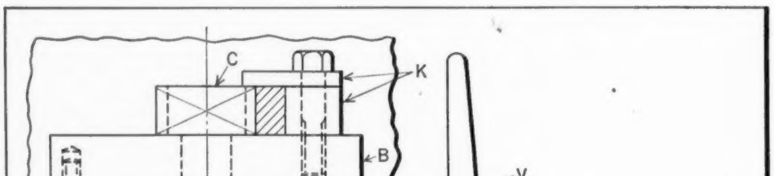


Fig. 1. Fixture Used on Punch Press for Bending Straight Blank V to the Curved Shape Shown at W

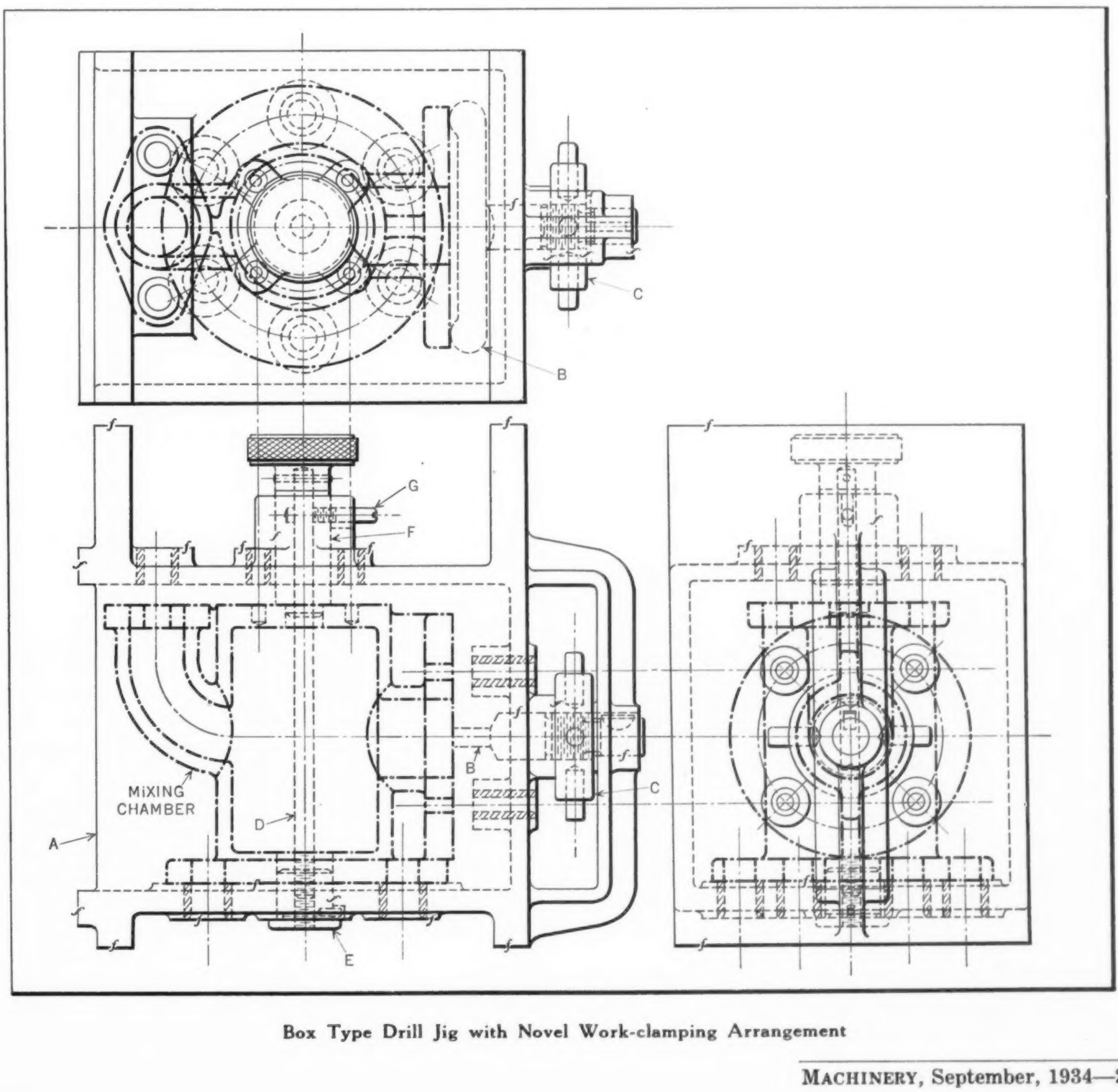
through an arc of 180 degrees. On the up stroke of the press, the roller returns to the position shown in Fig. 2. The finished blank is then removed by hand.

Jig for Drilling Sixteen Holes in Mixing Chamber

By C. W. PUTNAM, Athol, Mass.

The manner in which locating plugs are used for clamping purposes, as well as for positioning the work, is an interesting feature of the jig shown in the accompanying illustration. This jig is used for drilling a total of sixteen holes in three different sides of the cast mixing chamber shown by the heavy dot-and-dash lines. To remove the drilled mixing chamber from the jig, the equalizing bar *B* is first released by loosening nut *C*. This clamping nut is provided with a left-hand thread. The binding screw *D*, provided with a knurled knob as shown, is then unscrewed from the locating plug *E* and removed from the jig. The locating plug *F* is now lifted out of the reamed hole in the mixing chamber, using pin *G* for this purpose. Finally, the equalizing bar is withdrawn sufficiently to avoid interference with the flange on the next chamber to be drilled.

In loading the fixture, the mixing chamber is first located by the plug *E*. The locating plug *F* is then inserted in the reamed hole in the chamber. Next, the equalizing bar *B* is adjusted against the flange on the chamber, causing the chamber to swing around into position. This is accomplished by turning nut *C* clockwise. A Woodruff key, located in the shank of the equalizing bar, prevents the bar from moving out of position. The binding screw *D* is now tightened by means of the knurled knob secured to its upper end, causing the mixing chamber to be securely clamped in position for drilling.



Box Type Drill Jig with Novel Work-clamping Arrangement

Powerful Clamping Action Obtained by Lever-Operated Wedge

By F. SERVER

A method of clamping that permits a powerful grip to be applied to the work is illustrated in Fig. 1. By simply rotating the hand-lever *Q*, the wedge *E* is caused to clamp the work *B* against the locating and clamping surfaces of block *C*. A similar arrangement can be used advantageously on various kinds of jigs and fixtures.

The clamping wedge *E* acts on the work diagonally in the direction indicated by arrow *F*, thereby forcing the work against side *G* and end *H* of the locating block *C*. The front face of the wedge at *J* acts as a parallel clamp and is aligned with surface *G*. The beveled edge *K* of the wedge, which is retained in place by a steel block *L*, causes the wedge to exert clamping pressure when it is pulled to the right through the medium of link *M* and connecting pin *N*.

The right-hand end of link *M* fits over an eccentric stud *P*, mounted in a hole in the block *C*. Pinned to eccentric stud *P* is the hand-lever *Q* used for revolving stud *P* and moving link *M* to the right or left for the purpose of causing the wedge to clamp or release the work. There is a tongue and groove arrangement at *R*, the tongue being part of block *L*, and the groove a machined slot in the wedge. This construction serves to keep the wedge in contact with surface *K* when it is pushed to the left for releasing purposes.

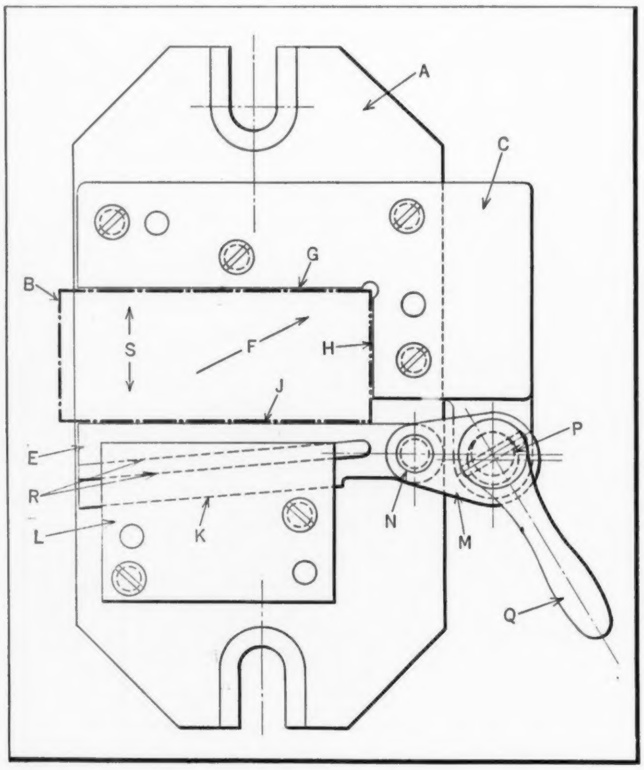


Fig. 1. Fixture with Clamping Action Provided by Lever-operated Wedge

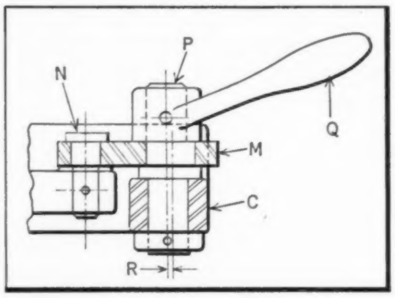


Fig. 2. Lever and Eccentric Stud Arrangement Used to Operate Clamping Wedge E, Fig. 1

Referring to Fig. 2, which shows a cross-section of the eccentric, it will be seen that lever *Q* is pinned to the eccentric stud *P* and that it moves link *M* about 1/4 inch during either half of a revolution of stud *P* through the medium of the eccentricity indicated at *R*. This, in turn, moves the wedge a similar amount, causing the clamping edge of the wedge to move in the direction *S*, Fig. 1, to clamp or release the work.

There is a relatively small clearance between the work and the gripping surfaces at *G* and *J*. About 1/2 revolution of lever *Q* serves to move the wedge *E* about 1/64 inch. This provides a quick-acting and very powerful grip for work that has previously been finished on the clamping surfaces. By changing the eccentricity of stud *P* or the angle of wedge *E*, the opening for gripping the work can be made much greater. An advantageous feature of this clamping method is that the work is located endwise while it is gripped diagonally.

* * *

Fifth International Foundry Congress

At the Fifth International Congress, to be held in conjunction with the thirty-eighth annual convention and exposition of the American Foundrymen's Association at Philadelphia, October 22 to 26, sessions will be held pertaining especially to cast iron, steel, and malleable cast iron foundry practice; non-ferrous castings; apprentice training; and materials handling. Sand and refractories will also be the subjects of special sessions. Modern developments will be presented from three angles—advance in technical knowledge; progress in operating practice; and latest designs and improvements in foundry equipment. All convention activities will be held under one roof in the New Auditorium in Philadelphia.

* * *

Mending Tracings

The usual method of mending tracing paper with transparent tape is not entirely satisfactory because the tape shows on the blueprint; and besides it does not hold well. Duco household cement, however, is not only an excellent adherent, but is absolutely transparent. Being a liquid, it can be applied exactly where the tracing is torn, and no excess amount need be applied. H. P.

One Hundred and One Pointers on Tungsten Carbide Milling

Factors that the Tool Designer and Tool Engineer Must Consider if the Best Results are to be Obtained with Tungsten Carbide in Milling and Other Operations

By FRANK W. CURTIS, Research Engineer
Kearney & Trecker Corporation
Milwaukee, Wis.

IN milling with tungsten and tantalum carbide, the cutter speeds can usually be from three to four times higher and the table feeds from two to three times faster than those used with high-speed steel cutters. To realize fully the advantages of carbide tools, however, certain requirements must be met. The one hundred and one recommendations given here not only include rules for the correct application of tungsten- and tantalum-carbide cutters, but also outline the basic factors that the tool designer and tool engineer should consider. These recommendations apply equally to all metal-cutting operations performed with tungsten- and tantalum-carbide cutters.

Machine Rigidity is Essential to Satisfactory Performance

1. Regardless of the class of milling to be done, be sure to have everything as strong and as rigid as possible, including the machine, the fixture and the cutter. Chatter and vibration are the worst foes of tungsten and tantalum carbide.

2. Carefully inspect the milling machine to be used. It should be in excellent operating condition.

3. Excessive backlash in the drive is likely to cause vibration. Remove all causes of vibration before attempting to use the machine. Sometimes a large flywheel on the spindle is of value.

4. Too much overhang of quill-type spindles will cause deflection. Arrange the set-up to avoid such overhang, unless the machine has a spindle support that provides proper rigidity.

5. Avoid using cutters larger in diameter than the driven gear on the spindle; otherwise chatter will develop, especially when the depth of cut is medium or heavy. Light cuts may be considered an exception.

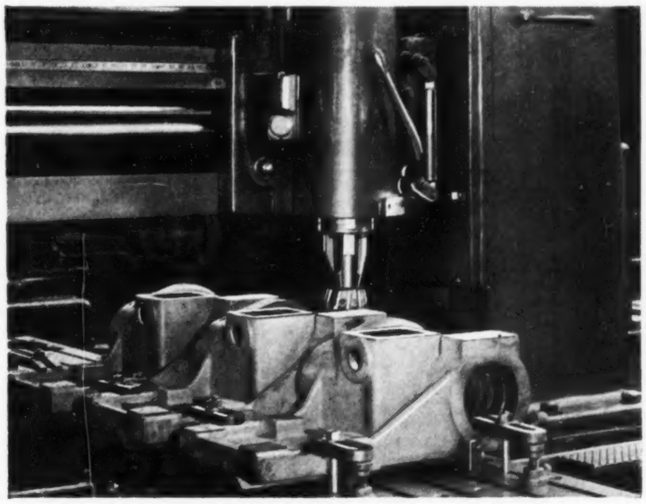
6. Do not use tungsten-carbide cutters in an old machine in poor condition.

7. Tungsten-carbide cutters can be used satisfactorily in existing machines if the machines are not too old, but be sure that there is not too much end play in the spindle or lead-screw. All bearing surfaces, ways, and sliding members should be in good condition.

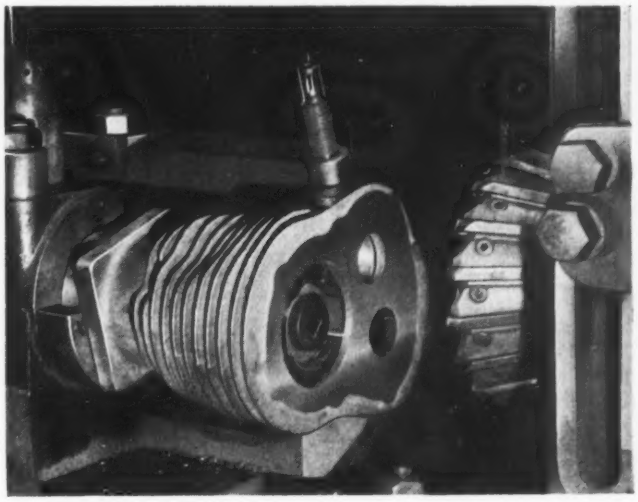
8. If chatter cannot be eliminated in a machine, abandon the use of tungsten-carbide cutters.

9. If in doubt as to the reliability of a machine, test it with a tungsten-carbide cutter at the speeds and feeds you intend using. A block of cast iron can be used in making this test.

Milling Three Spindle Slides of a Special Machine at One Setting with Tungsten-carbide Cutters. Surfaces at Two Elevations are to be Machined. Cutting Speed, 250 Feet per Minute; Feed, 17 Inches; Depth of Cut, 1/8 Inch



Milling the Cylinder-head Face of a Motorcycle Cylinder with a 7 1/2-inch Cutter. Production Increased 40 Per Cent; Surface Finish Improved; Cutting Speed, 275 Feet per Minute; Feed, 21 Inches; Depth of Cut 1/8 Inch



10. Never attempt to do a heavy job in a light machine. Overloading any machine may cause serious trouble.

11. To play safe, be sure the motor is of the required capacity. Sometimes a larger motor is needed.

12. Obsolete equipment will not prove the value of carbide tools.

13. A machine especially designed for the use of carbide tools is always to be preferred, because proper speeds, feeds, strength, and smoothness of operation have been provided for.

14. Keep accurate records of speeds, feeds, depths of cut, and operating performances. They will serve as a reference for other operations.

15. Provide heavy well-constructed fixtures. Add 50 per cent or more weight than usual to insure rigidity. Where sections were formerly 1/2 inch, make them 3/4 inch, and if 3/4 inch was enough in the past, make them 1 1/8 inches now. Follow these proportions throughout the design.

16. Make the fixture as foolproof as possible.

17. Make sure that the work cannot get loose. If possible, design the fixture in such a way that the piece could not get into the path of the cutter even if it did loosen.

18. Use heavy, positive clamps. Proper clamping is a most important requirement.

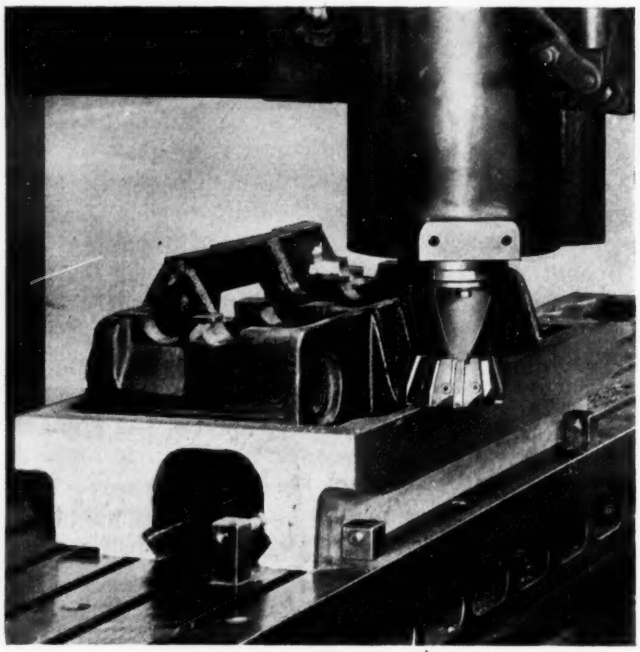
19. Do not locate members too close to the path of the cutters. Carelessness of the operator must be considered.

20. Avoid the use of long, narrow, or thin clamps, because they seldom offer solid clamping.

21. Do not locate rough flat castings on a flat surface. Use hardened buttons and spring plungers at the proper points. Locating on a flat surface seldom provides a rigid support, unless the part has been previously machined.

22. Provide fast, accurate clamping means wherever possible, especially when the loading time becomes a factor. Try to reduce the loading time in proportion to the reduction gained in the cutting time.

23. Facilities for the removal of chips must be provided. Make the fixture so that the chips can come out easily or with the least possible effort.



Milling a Milling Machine Saddle. Tungsten-carbide Cutters Have Increased the Output Approximately 50 Per Cent, with Improved Finish. The Cutter is Operated at a Speed of 250 Feet per Minute, with a Feed of from 17 to 21 Inches per Minute

24. If set blocks are to be used for the cutters, do not specify hardened feelers or set blocks. Use a soft set block and replace it when necessary.

25. Keep the work as close as possible to the table and to the column or upright of the machine.

26. Be sure the work can be ejected easily from the fixture. Make use of a mechanical ejector if necessary.

27. When large fixtures are needed, consider the use of cast-steel bodies. A welded construction, if heavy, is satisfactory.

28. When air clamping is to be used, avoid mounting the clamps directly on the air-cylinder plunger. Use a positive-locking toggle, wedge, cam, or some similar means.

29. In horizontal face milling, always favor down-cutting. If the cutter must cut upward, as is necessary in reciprocating milling, be sure the clamps are heavy enough to insure rigidity.

30. Use semi-automatic clamping means when possible. The fixture should be designed so that locating, aligning, and clamping are done by turning one lever or handwheel. Self-locking clamp units are an aid in fixtures of this kind.

31. Clamp the work solidly over the locating points to avoid any possible spring.

32. When locating thin, frail pieces, provide ample support at as many points as are required to avoid chatter. Spring plungers and self-aligning support rests will be of great help.

33. In some cases it may be necessary to have guards to deflect flying chips. Whether attached to the fixture or to the machine, be sure to keep them out of the way of the cutter.

34. Sometimes guards are necessary for the safety of the operator. Make them heavy, rigid, and safe.

35. Always mill against the solid locating portions of the fixture.

36. Use the best of materials and workmanship in building fixtures.

37. Give much thought to the selection of locating and clamping points so that the work will be held by the best possible means.

38. Never overlook the safety of the operator, as the cutters operate at high speed. Every pre-

caution should also be taken to safeguard the set-up.

39. When a machine is used for different operations at short intervals, try to group similar operations and to design the fixtures so that the faces to be milled will be in the same relation to the cutter. This will reduce set-up time. Sometimes it will pay to use a machine of such range and capacity that two fixtures can be employed at one time.

40. Tool cost is not always the governing factor. Expensive tools are sometimes quickly paid for through increased output.

41. Arrange the fixture, if possible, so that the work will be held as if it were a solid block. The more solid the piece, the faster it can be milled.

42. If a coolant is to be used, provide for an adequate supply at the cutting point.

43. When a coolant is used, be sure that channels are provided for carrying away the coolant and chips.

44. Be sure that chips do not interfere with the locating and clamping of the work.

45. Avoid "trick" fixture designs, unless the principles have been proved successful.

Hints on the Construction and Use of Tungsten-Carbide Milling Cutters

46. Regardless of the type, the cutter should be as strong as possible.

47. Inserted-blade cutters are to be preferred to the solid type of cutter in which several tungsten-carbide inserts are brazed to a single one-piece body. Inserted blades provide for economical replacement.

48. Provide adequate support for the tungsten-carbide cutting edge. Lack of support will cause deflection and failure.

49. Small cutters can be made by tack-welding tipped blades in a steel body. This design permits the blades to be removed individually if necessary.

50. A positive lock should be provided for the blades. They should not have an opportunity to pull out or push away from the cut.

51. Provide suitable arbors. Use centering plugs for large cutters, even though the cutters fit over the spindle nose.

52. Be sure the cutter is properly driven.

53. Be sure that the rake or hook angle and the face angle are suitable for the material to be machined.

54. Provide ample chip clearance.

55. Avoid the use of long narrow tungsten-carbide tips. If the cut is deep, use proportionately larger tips.

56. When a deep cut is to be taken, be sure to use a heavy-duty cutter and not one intended for the average cut.

57. When the work is thin and frail, use a fine-pitch cutter. If the surface being faced is broad, it will be possible to use a cutter of coarser pitch.

58. Do not overload the cutter. Be sure that its design is suitable for the nature of the cut.

59. If you make the blades, be sure the brazing of the tips is well done. There might be an accident if one tip should become loose.

60. Either rectangular or triangular tips will be found satisfactory as long as there is ample carbide for the nature of the cut.

61. Sharp corners should be avoided on cutters. Provide a slight radius or a 45-degree angle at the corners.

62. Never use an old cutter body. The chances are that the angles and design are incorrect. Use a body basically designed for tungsten-carbide milling.

63. Use the correct grade of carbide. If in doubt, consult a manufacturer.

64. Be sure the cutter body has proper means of alignment with the spindle of the machine.

65. For finishing cuts, the blades can be made with the tungsten-carbide tips across the entire face. Cutters made this way will produce an unusually smooth finish.

66. The cutter body should have means of adjusting the blades outward in increments of approximately 1/16 inch to compensate for normal wear.

67. The tungsten-carbide insert must be heavy enough to withstand the pressure of cutting. If the tip is too thin, it will have a tendency to crack, unless the cut is very light.

Much Depends on the Cutter Grinding

68. Use a cutter grinder of suitable size that is in good operating condition.

69. Use the correct grade of abrasive wheel.

70. Sharpening of cutters should be done with great care at first until the proper "feel" is acquired.

71. Not more than 0.0005 inch of stock should be removed from a tungsten-carbide tip in one pass. Move the wheel back and forth against the face of the blade with a steady motion.

72. Inspect the cutter before it is removed from the sharpening machine. A dial indicator can be mounted on the machine for this purpose.

73. The limits of accuracy in sharpening cutters depend upon the nature of the finish required. For general-purpose work, the faces of the blades should be held within 0.0005 inch. Keep the diameter uniform within 0.0015 inch.

74. Whenever possible, sharpen the cutters on the arbor on which they are to be used. This will lessen the chance of misalignment in changing from one arbor to another.

75. Do not allow cutters to become too dull. If the cutting edges become badly rounded or worn, more sharpening time will be necessary. If more than 0.005 inch of stock must be removed from any cutting edge, the cutter has been operated too long. Usually from 0.003 to 0.004 inch of stock removal is all that is needed.

76. Dress the abrasive wheel frequently to prevent glazing and to avoid heating of the blades.

77. If a coolant is used, be sure there is a heavy flow. Dry grinding is entirely satisfactory, but care should be taken not to grind continuously on one blade.

78. Use grinding wheel speeds around 5000 to 6000 feet a minute. If the wheel runs too slow, it will wear away quickly.

79. Be sure that all the cutter faces are ground smooth and free from wheel marks.

Rules to be Followed in Applying Tungsten-Carbide Cutters

80. The characteristics of tantalum and tungsten carbide should be fully explained to the machine operator.

81. If possible, the cutter should not be returned over a milled surface. If the cutter must be returned this way, be sure that it is rotating and not stopped.

82. When the spindle is to be stopped in the cut, be sure to disengage the feed. Stopping the spindle with the feed engaged subjects the cutting edges to severe strains.

83. Do not allow the cutter to rotate or scrape against a hard surface or shoulder.

84. In rapid traversing up to the cut, the spindle should be rotating. If a "dead" cutter should strike a solid obstruction, there would be danger of breaking a blade.

85. Do not operate a vibrating cutter. If the cutter has not previously vibrated, inspect the grind for a possible cause.

86. Avoid the use of tungsten-carbide cutters on jobs where the work is not held securely.

87. Be sure that the cutter revolves in the right direction.

88. Thoroughly check the entire set-up before starting the cutter.

89. On a new job, it is well to start at slow speeds and feeds, and to increase them gradually by trial until the anticipated results are achieved.

90. If a substantial gain is to be made through the use of tungsten-carbide cutters, it will be well to provide some compensation for the operator.

Advantages Obtained by Using Tungsten-Carbide Cutters

91. The outstanding gains in milling with tungsten and tantalum carbide are higher speeds and faster feeds.

92. Longer cutter life between grinds is obtained, even though speeds and feeds are increased, provided, of course, that the set-up is rigid.

93. Owing to the increased milling speed, it is possible to maintain greater accuracy.

94. An unusually smooth finish is obtained.

95. Since the metal is removed at high speed, there is less distortion of the work.

96. Less heat is generated in the work because of the high speeds. Practically all the heat is dissipated through the chips.

97. The depth of cut can be reduced in many cases, creating a saving in metal.

98. Roughing and finishing cuts can often be combined and a good finish obtained—sometimes better than with two cuts.

99. On account of the high cutting speed and the slight reduction in feed per revolution, there is a tendency to reduce the chipping or breaking away of the edges on the work.

100. Harder materials can be machined than heretofore. Feeds and speeds proportionate with the hardness must be used.

101. Remember that practically every failure of tungsten-carbide milling can be traced to lack of rigidity in the machine, fixture, or cutter. Rigidity of all three is absolutely necessary.

* * *

Bonus in the Tool-Room

By WILLIAM C. BETZ

For many years, the company with which the writer is connected has applied a bonus to tool, die, and machine work performed in the tool-room, and we have considered our system good and equitable to all concerned. Recently, however, some of our men have voiced dissatisfaction with certain features of the system. Our work consists of making all kinds of tools, gages, jigs, chucks, dies, and assembly devices; building special machinery; and general machine rebuilding and repair.

I would like to obtain the suggestions of superintendents, tool-room foremen, and other mechanical executives who have had experience with bonus systems on tool work. Have such systems, as applied in their plants, proved successful? Would it be feasible to place about 70 per cent of the work in the tool-room on a bonus basis in such a way that all the men in the department could share in the bonus earnings? What is considered a fair method for establishing such a bonus, and what percentage ought the bonus to average, over regular hourly wages?

* * *

I believe that we will be able to solve our industrial problems if we are given an opportunity. Mistakes, of course, will be made, just the same as mistakes are made in the designing of a new machine. It may also be that we are not quite yet capable of adequately solving our industrial and economical problems, just as fifty years ago we were not capable of solving the problem of aerial transportation. But, in time, we solved that problem, and so we will also, in time, be able to solve our industrial problems, if we apply ourselves as conscientiously to the job as did the engineers who solved the problem of conquering the air.—*From the Letter of an Engineer*

Reducing Fabrication Costs by Spot-Welding

By H. K. LIEDY
The Electric Controller & Mfg. Co., Cleveland, Ohio

A Review of the Important Principles and Practices Involved in Spot-Welding

A Summary of the Essential Characteristics of the Equipment Used for This Process

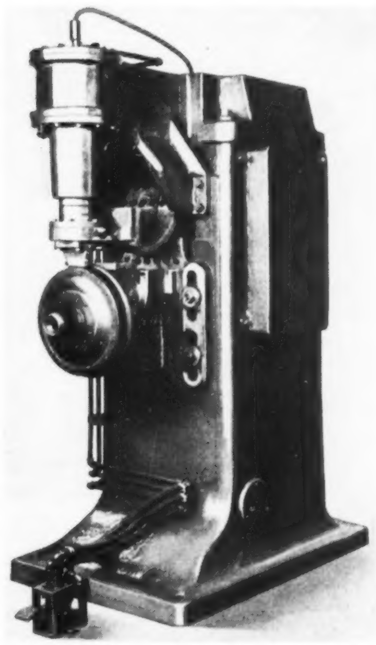


Fig. 1. Welding Balancing Pieces to Brake-drums, Using an Automatic Weld Timer to Insure Accurate Time Control

SINCE spot-welding is one of the easiest and quickest methods of joining two pieces of metal, it is quite natural that manufacturers should carefully consider the spot-welding process when confronted with the problem of joining two or more pieces. Frequently failure to secure uniformly satisfactory welds has discouraged the more universal application of the process. Careful investigation, however, usually reveals that the causes of poor welds can easily be removed or controlled, so that a good product at low cost may be obtained.

Briefly, the spot-welding process consists of overlapping the pieces to be joined and placing them between the two electrodes of a welding machine. An electric current passes from electrode to electrode, through the pieces. Resistance to the flow of the electric current causes heat to be generated at the point of contact, raising the temperature of the metals to a welding heat. The current is then cut off by mechanical or magnetic means. Simultaneously, pressure applied to the electrodes squeezes the metals together, forming the weld.

The quality of welds is affected by the following factors: (1) The shape and condition of the electrodes; (2) the number of heat units put into each weld—that is, the amount of current that flows through the pieces and the length of time during which it flows; and (3) the amount of pressure applied to form the weld.

The shape and condition of the electrodes has much to do with the character of the welds. The electrodes in general use consist of two truncated cones, the diameter of the ends that come in contact with the work varying according to the thickness of the metal and the strength of weld desired. This style of electrode generally leaves an indentation or impression on both sides of the work. Sometimes this is objectionable, especially when a smooth surface is required on one side for finishing operations. In such cases, one flat electrode and one of the conventional style may be used. The surface will be smooth where the flat electrode comes in contact with the work.

Another style is the spherical or ball-pointed electrode. This type can be made with varying radii, and its advantage lies in the fact that a high pressure can be obtained at a single point. These electrodes are useful for welding scaly materials.

To secure the best results, the electrodes should be kept in good condition. Even though they are dressed to a bright clean surface, repeated use will oxidize them. Pitting and roughening will likewise occur, causing surface marks on the work and offering greater resistance to the flow of the current. This makes it necessary to pass the current through the electrodes for a longer period of time to get the same uniformity of welding. It is, therefore, essential that electrodes be frequently inspected and dressed.

Spot-welding machines usually are equipped with means for adjusting the amount of pressure on the electrodes. On manually operated machines, the correct pressure can be secured by adjusting the compression of a spring, and on automatically operated machines, by varying the amount of pressure in an air or hydraulic cylinder. Generally, there is no difficulty in maintaining this pressure at its proper value.

The number of heat units put into each weld is

of major importance and, prior to the development of automatic timing devices, caused most of the difficulties encountered in the spot-welding process. The operator had to judge the length of time that the current should be left on by the color of the pieces being welded. Since this time was generally only a fraction of a second, burned and discolored surfaces often resulted from too long a heating period, while weak and inadequate welds resulted from too short a heating period.

It is easier to spot-weld some metals than others. Steel, for example, is easily welded because of its high resistance to the flow of current and its low thermal conductivity. These properties permit of considerable latitude in the amount of welding current and the length of time it is allowed to flow. In the case of non-ferrous metals and alloys of high thermal conductivity, however, the range is much smaller and requires more accurate control to produce good uniform welds.

Aluminum requires extremely accurate control of the number of heat units put into the weld. This metal can be welded easily with a high current and short heating time; but since it shows practically no color and changes rapidly at forging temperature from the solid to the molten state, the time the welding current flows must be accurately controlled to produce welds of uniform quality, especially on a production basis.

Although it is difficult to formulate a general rule for the amount of current and time required for different materials, the use of a high current and a short time generally gives the best results. This is true even when it is known that a metal has high resistance to the flow of current. Stainless steel, for example, has a resistance of from eight to ten times that of ordinary steel, and consequently can be welded with a low current. High current with extremely short time, however, is used to obtain a weld without surface discoloration and one in which the corrosion-resisting properties of the metal are not destroyed.

A question that is often asked is: "Can small parts be spot-welded as satisfactorily as those of larger dimensions?" Generally speaking, the answer to this question is "Yes"; but there are difficulties when a very small piece is welded to one of considerably larger dimensions. It is evident that the heat required to bring the larger piece to a temperature sufficient to insure a good weld may produce too much heat in a small part—say a wire—and possibly burn it off. It is for this reason that the number of heat units put into each weld must be controlled accurately, so that a good weld is obtained without injuring the smaller part.

Fig. 2. Small V-belt Sheave Formed by Spot-welding Two Pressed-steel Disks Together

Fig. 2 shows a typical part suitable for spot-welding. This is a V-belt sheave made from two pressed sheet-metal disks. The welding machine on which these sheaves are produced is equipped with an automatic timer which is automatically energized by the closing of the magnetic contactor handling the main welding current. When the required number of heat units has been put into the pieces to be welded, the timer disconnects the main line contactor, stopping the flow of current.

A small rheostat mounted on the timer permits the length of heating time to be adjusted to suit various requirements, as, for example, in welding different materials. However, when adjusted to provide uniform welds for a given product, the timer does not need to be changed for variations occurring in the welding circuit such as may be caused by (1) an increase in the thickness of the pieces to be welded; (2) an increase in the number of pieces to be welded; (3) a drop in line voltage; and (4) an increase in the resistance of the welding circuit due to rough, pitted, or oxidized electrodes or to the surface conditions of the parts welded.

The timer automatically compensates for these variations, accurately controlling the number of required heat units. For example, in the balancing of brake-drums on a popular make of automobile, as illustrated in Fig. 1, it is necessary to weld to the circumference of these drums two pieces to produce a balanced drum. The projection type of welding is used in this instance. This process is similar to spot-welding, except that it is necessary for one of the pieces being welded to be first stamped to form a projection at the point where the weld is to be made. This method saves time, insures that the welds are produced at the desired points, and does not require as careful dressing of the electrodes as is necessary for spot-welding.

These brake-drums are of the centrifuse type and are composed of steel, to the inside of which is fused by a centrifugal casting process, a layer of iron, in order to provide a surface having exceptionally good wearing qualities. It is extremely important that the timing of these welds be accurately controlled. The time must be long enough to insure strong welds between the balancing pieces and the outer circumference of the drum, and yet brief enough to prevent so much heat as to cause "blue rings" on the inner side of the drum. These blue rings are hard spots which, if permitted to form, will affect the wearing qualities of the surface.

Rockwell-Brinell Conversion Tables

THE accompanying tables are the first complete conversion tables that have been published giving the relationship between the standard Brinell hardness numbers and all of the recognized Rockwell scales, including those of the normal and "Superficial" types of the Rockwell tester, the latter being the shallow indentation model employed in testing thin sheets, nitrided steel, and lightly carburized steel. The values in these tables have been determined in the testing laboratory of

Table 1. Rockwell and Brinell Hardness Numbers Compared

Rockwell B Scale 1/16" Ball 100 kg. Load Red Figures	Rockwell E Scale 1/8" Ball 100 kg. Load Red Figures	Rockwell F Scale 1/16" Ball 60 kg. Load Red Figures	Rockwell G Scale 1/16" Ball 150 kg. Load Red Figures	Brinell Numbers 500 or 1000 kg. Load	Rockwell Superficial 15-T Scale 1/16" Ball 15 kg. Load	Rockwell Superficial 30-T Scale 1/16" Ball 30 kg. Load	Rockwell Superficial 45-T Scale 1/16" Ball 45 kg. Load	Rockwell B Scale 1/16" Ball 100 kg. Load Red Figures	Rockwell E Scale 1/8" Ball 100 kg. Load Red Figures	Rockwell F Scale 1/16" Ball 60 kg. Load Red Figures	Rockwell G Scale 1/16" Ball 150 kg. Load Red Figures	Brinell Numbers 500 or 1000 kg. Load	Rockwell Superficial 15-T Scale 1/16" Ball 15 kg. Load	Rockwell Superficial 30-T Scale 1/16" Ball 30 kg. Load	Rockwell Superficial 45-T Scale 1/16" Ball 45 kg. Load
100	114.5	114.0	82.0	242	93.0	83.0	73.0	49	88.5	85.5	....	92	77.5	51.0	25.0
99	114.0	113.5	80.0	235	92.5	82.5	72.0	48	88.0	85.0	....	90	77.5	50.5	24.0
98	113.5	112.5	78.5	228	92.5	82.0	71.0	47	87.0	84.5	....	88	77.0	50.0	23.0
97	113.0	112.0	77.0	222	92.0	81.0	70.0	46	86.5	84.0	....	87	77.0	49.5	22.0
96	112.5	111.5	75.5	216	92.0	80.5	69.0	45	86.0	83.5	....	86	76.5	49.0	21.0
95	112.0	111.0	74.0	210	91.5	80.0	68.0	44	85.5	83.0	....	85	76.0	48.0	20.0
94	111.5	110.5	72.0	205	91.0	79.0	67.0	43	85.0	82.5	....	83	76.0	47.5	19.0
93	111.0	110.0	70.0	200	91.0	78.5	66.0	42	84.5	82.0	....	82	75.5	47.0	18.0
92	110.5	109.5	68.5	195	90.5	78.0	65.0	41	84.0	81.5	....	81	75.0	46.5	17.0
91	110.0	109.0	67.0	190	90.0	77.0	64.0	40	83.0	81.0	....	80	75.0	46.0	16.0
90	109.5	108.5	65.5	185	90.0	76.5	63.0	39	82.5	80.0	....	79	74.5	45.0	15.0
89	109.0	108.0	64.0	179	89.5	76.0	62.0	38	82.0	79.5	....	78	74.5	44.5	14.5
88	108.5	107.5	62.0	176	89.5	75.0	61.0	37	81.0	79.0	....	77	74.0	44.0	13.5
87	108.0	107.0	60.0	172	89.0	74.5	60.0	36	80.5	78.5	....	76	74.0	43.0	12.5
86	107.5	106.0	58.5	169	89.0	74.0	59.5	35	80.0	78.0	....	75	73.5	42.5	11.5
85	107.0	105.5	57.0	165	88.5	73.5	58.5	34	79.5	77.5	....	75	73.0	42.0	10.5
84	106.5	105.0	55.0	162	88.0	73.0	57.5	33	79.0	77.0	....	74	73.0	41.0	9.5
83	106.0	104.5	53.5	159	88.0	72.0	56.5	32	78.0	76.0	....	74	72.5	40.5	9.0
82	105.5	104.0	52.0	156	87.5	71.5	55.5	31	77.5	75.5	....	73	72.0	40.0	8.0
81	105.0	103.5	50.0	153	87.0	71.0	54.5	30	77.0	75.0	....	72	72.0	39.0	7.0
80	104.5	103.0	48.5	150	87.0	70.5	53.5	29	76.5	74.5	....	71	71.5	38.5	6.0
79	104.0	102.0	47.0	147	86.5	70.0	52.5	28	76.0	74.0	....	71	71.5	38.0	5.0
78	103.5	101.5	45.5	144	86.5	69.0	52.0	27	75.0	73.5	....	70	71.0	37.0	4.0
77	103.0	101.0	43.5	141	86.0	68.5	51.0	26	74.5	73.0	....	69	71.0	36.5	3.0
76	102.5	100.5	42.0	139	86.0	68.0	50.0	25	73.5	72.5	....	68	70.5	36.0	2.0
75	102.0	100.0	40.5	137	85.5	67.5	49.0	24	73.0	72.0	....	67	70.0	35.0	1.0
74	101.5	99.5	38.5	135	85.0	66.5	48.5	23	72.0	71.5	....	66	70.0	34.5	0
73	101.0	99.0	37.0	132	85.0	66.0	47.5	22	71.5	71.0	....	66	69.5	34.0	....
72	100.5	98.5	35.5	130	84.5	65.5	46.5	21	71.0	70.0	....	65	69.0	33.0	....
71	100.0	98.0	33.5	127	84.0	65.0	45.5	20	70.0	69.5	....	65	69.0	32.5	....
70	99.5	97.5	32.0	125	84.0	64.0	44.5	19	69.0	69.0	....	64	68.5	32.0	....
69	99.0	97.0	30.5	123	83.5	63.5	43.5	18	68.5	68.5	....	64	68.5	31.0	....
68	98.5	96.0	28.5	121	83.5	63.0	42.5	17	68.0	68.0	....	63	68.0	30.5	....
67	98.0	95.5	27.0	119	83.0	62.0	42.0	16	67.0	67.5	....	63	68.0	30.0	....
66	97.5	95.0	25.5	117	83.0	61.5	41.0	15	66.5	67.0	....	62	67.5	29.0	....
65	97.0	94.5	24.0	116	82.5	61.0	40.0	14	66.0	66.5	....	62	67.0	28.0	....
64	96.5	94.0	22.0	114	82.0	60.5	39.0	13	65.0	66.0	....	62	67.0	27.5	....
63	96.0	93.5	20.5	112	82.0	60.0	38.0	12	64.5	65.0	....	61	66.5	26.5	....
62	95.5	93.0	19.0	110	81.5	59.0	37.0	11	64.0	64.5	....	61	66.0	25.5	....
61	95.0	92.5	17.5	108	81.0	58.5	36.0	10	63.0	64.0	....	60	66.0	25.0	....
60	94.5	92.0	16.0	107	81.0	58.0	35.0	9	62.0	63.5	....	60	65.5	24.0	....
59	94.0	91.0	14.0	106	80.5	57.5	34.0	8	61.5	63.0	....	59	65.5	23.0	....
58	93.5	90.5	12.5	104	80.5	57.0	33.0	7	61.0	62.5	....	59	65.0	22.0	....
57	93.0	90.0	11.0	103	80.0	56.0	32.5	6	60.0	62.0	....	58	65.0	21.0	....
56	92.5	89.5	9.5	101	80.0	55.5	31.5	5	59.5	61.5	....	58	64.5	20.0	....
55	92.0	89.0	8.0	100	79.5	55.0	30.5	4	58.5	60.5	....	58	64.0	19.5	....
54	91.0	88.5	6.0	98	79.0	54.5	29.5	3	58.0	60.0	....	58	64.0	18.5	....
53	90.5	88.0	4.5	97	79.0	53.5	28.5	2	57.5	59.5	....	57	63.5	17.5	....
52	90.0	87.0	2.5	96	78.5	53.0	28.0	1	56.5	59.0	....	57	63.0	17.0	....
51	89.5	86.5	1.0	95	78.0	52.5	27.0	0	....	....	....	..	63.0	16.0	....
50	89.0	86.0	....	93	78.0	52.0	26.0	..	....	....	....	..	....	....	....

Table 2. Rockwell and Brinell Hardness Numbers Compared

Rockwell C Scale Brale Penetrator 150 kg. Load Black Figures	Rockwell A Scale Brale Penetrator 60 kg. Load Black Figures	Rockwell D Scale Brale Penetrator 100 kg. Load Black Figures	Brinell Numbers 10 mm. Steel Ball 3000 kg. Load	Rockwell Superficial 15-N Scale N Brale Penetrator 15 kg. Load	Rockwell Superficial 30-N Scale N Brale Penetrator 30 kg. Load	Rockwell Superficial 45-N Scale N Brale Penetrator 45 kg. Load	Rockwell C Scale Brale Penetrator 150 kg. Load Black Figures	Rockwell A Scale Brale Penetrator 60 kg. Load Black Figures	Rockwell D Scale Brale Penetrator 100 kg. Load Black Figures	Brinell Numbers 10 mm. Steel Ball 3000 kg. Load	Rockwell Superficial 15-N Scale N Brale Penetrator 15 kg. Load	Rockwell Superficial 30-N Scale N Brale Penetrator 30 kg. Load	Rockwell Superficial 45-N Scale N Brale Penetrator 45 kg. Load
65	84.5	75.0	690	92.5	82.0	72.0	41	72.0	56.5	382	80.5	61.0	45.0
64	83.5	74.0	673	92.0	81.0	71.0	40	71.5	56.0	372	80.0	60.0	44.0
63	83.0	73.0	658	91.5	80.0	70.0	39	71.0	55.0	362	79.5	59.0	43.0
62	82.5	72.5	645	91.0	79.0	69.0	38	70.5	54.5	352	79.0	58.0	42.0
61	82.0	72.0	628	90.5	78.5	68.0	37	70.0	53.5	342	78.5	57.5	40.5
60	81.5	71.0	614	90.0	77.5	66.5	36	69.5	53.0	333	78.0	56.5	39.5
59	81.0	70.5	600	89.5	77.0	65.5	35	69.0	52.0	322	77.5	56.0	38.5
58	80.5	69.5	587	89.0	76.0	64.5	34	68.0	51.5	313	77.0	55.0	37.5
57	80.0	69.0	573	88.5	75.0	63.5	33	67.5	50.5	305	76.5	54.0	36.0
56	79.5	68.0	560	88.0	74.0	62.0	32	67.0	50.0	296	76.0	53.0	35.0
55	79.0	67.0	547	87.5	73.5	61.0	31	66.5	49.0	290	75.5	52.0	34.0
54	78.5	66.5	534	87.0	72.5	60.0	30	66.0	48.5	283	75.0	51.5	33.0
53	78.0	65.5	522	86.5	71.5	59.0	29	65.5	47.5	276	74.5	50.5	31.5
52	77.5	65.0	509	86.0	70.5	57.5	28	65.0	47.0	272	74.0	49.5	30.5
51	77.0	64.0	496	85.5	70.0	56.5	27	64.5	46.0	265	73.5	48.5	29.5
50	76.5	63.5	484	85.0	69.0	55.0	26	64.0	45.5	260	73.0	48.0	28.5
49	76.0	62.5	472	84.5	68.0	54.0	25	63.5	44.5	255	72.5	47.0	27.0
48	75.5	62.0	460	84.0	67.0	53.0	24	63.0	44.0	248	72.0	46.0	26.0
47	75.0	61.0	448	83.5	66.0	52.0	23	62.5	43.0	245	71.5	45.0	25.0
46	74.5	60.5	437	83.0	65.5	51.0	22	62.0	42.0	240	71.0	44.5	24.0
45	74.0	59.5	426	82.5	64.5	49.5	21	61.5	41.5	235	70.5	43.5	23.0
44	73.5	59.0	415	82.0	63.5	48.5	20	61.0	41.0	230	70.0	43.0	22.0
43	73.0	58.0	404	81.5	62.5	47.5	..	....	....	..	....	....	....
42	72.5	57.5	393	81.0	62.0	46.5	..	....	....	..	....	....	....

the Wilson Mechanical Instrument Co., Inc., New York City.

All so-called "conversion" tables of hardness scales, including those here published, are and must be based on the assumption that the metal tested is homogeneous to a depth several times as great as the depth of the indentation, because different loads and different shapes of penetrators would, in metal not homogeneous, penetrate—or at least meet the resistance of—metal of varying hardness, depending upon the depth of the indentation. Hence, no definite hardness value would actually exist.

Conversion tables dealing with hardness can be only approximate and never mathematically exact, for it must be understood that a penetration hardness test proceeds until the specimen tested supports the applied load. Yet it is a severely cold-worked metal that actually supports the penetrator, and different metals have different cold-working properties. Nevertheless, while a conversion table cannot be mathematically exact, it is of considerable value to be able to compare different hardness scales in a general way.

In further explanation of the tables, the following information pertaining to the different Rockwell hardness testing machines and the scales used for them will prove of value to those who may not be thoroughly familiar with the different Rockwell hardness testing devices and scales.

The Rockwell tester was first made with a dial gage of 100 divisions, a major load of 100 kilograms, and a ball penetrator 1/16 inch in diameter. Later, the tester was equipped to apply a major load of 150 kilograms, and a sphero-conical diamond penetrator, known as the "Brale," was devised for testing hard steel.

To differentiate between the two methods, the letters B and C were adopted for the two standard Rockwell scales, the letter B applying to tests with a ball penetrator of 1/16 inch diameter and a 100-kilogram major load, for testing relatively soft metals, and the letter C to tests with the diamond penetrator having a rounded point and a 150-kilogram major load.

A committee of the American Society for Testing Materials having under consideration values determined at various plants on the Rockwell tester with a 1/8-inch ball penetrator and a 100-kilogram major load referred to this as Special Rockwell E scale hardness, and subsequently requested the makers of the Rockwell hardness tester to give recognition to the letter E for a scale that would denote the combination of a 1/8-inch ball penetrator and a 100-kilogram major load.

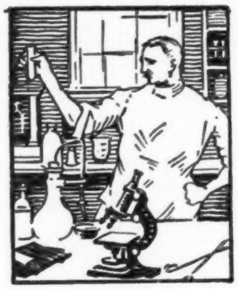
Then a number of metallurgists interested in testing tungsten-carbide alloys employed the sphero-conical Brale penetrator with a 60-kilogram major load and took readings that they referred to as the Rockwell A scale. This scale is now designated as the Special Rockwell A scale. In addition, there are:

Special Rockwell D scale, obtained with a diamond Brale penetrator and a 100-kilogram load.

Special Rockwell F scale applying to a 1/16-inch steel ball penetrator with a 60-kilogram load.

Special Rockwell G scale applying to a 1/16-inch steel ball penetrator with a 150-kilogram load.

MATERIALS OF INDUSTRY



THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

"Cecolloy"—a Series of Iron Alloys for Large Castings

Nickel-molybdenum air-furnace iron alloys have been used during the last few years for comparatively small castings, but their use has not extended to castings as large as those required in the construction of forging hammers, power presses, and similar heavy-duty machinery. For this class of service, the Chambersburg Engineering Co., Chambersburg, Pa., has developed a series of nickel-molybdenum alloys which are known by the trade name of "Cecolloy." They are the result of a research made with the aim of producing castings that would increase the accuracy and reduce the maintenance costs of forging hammers.

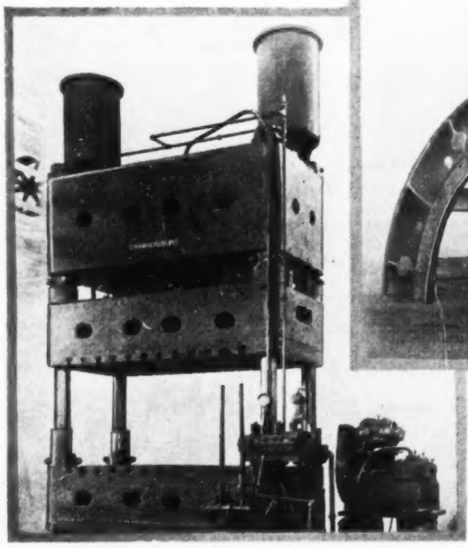
The new alloys are produced in an air furnace which is capable of maintaining exceptional temperatures during the rather extended period of carbon conversion, which is a fundamental requisite of high-strength iron alloys. The chief characteristics of Cecolloy are a fine, homogeneous grain structure, a tensile strength of from 40,000 to 60,000 pounds per square inch, and a Brinell hardness which can be controlled in the furnace to suit the purpose for which the casting is intended. The carbon content can be controlled within plus or minus 0.05 per cent. Cecolloy can be finished to a clean smooth surface.

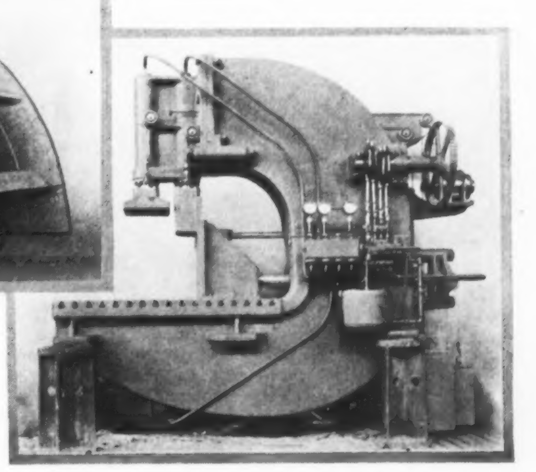
Castings weighing up to 50 tons have been produced successfully from Cecolloy. The alloy is recommended for such castings as forming dies, beds of heavy-duty machine tools, steam-cylinder liners and rings, crushing machinery, and similar equipment. The concern is in a position to make castings of Cecolloy for other companies.

A Molded Metallic Material that Resists Heat and Corrosion

"Kux Hi-Heat" is the trade name which has been given to a molded metallic material recently made available by the Kux-Lohner Machine Co., 2145-47 Lexington St., Chicago, Ill. This material possesses properties that make it suitable for use where resistance to heat and corrosion are necessary. Creamery, dairy, and food-product equipment can be made from this material, because it is unaffected by food and weak solutions of most acids and alkalies. Die-casting dies and synthetic plastic molds can also be made from this material.

"Kux Hi-Heat" is non-oxidizing, has no grain





Large Castings of Cecolloy—an Iron Alloy Suitable for Heavy Duty

growth up to 1800 degrees F., is highly resistant to corrosion, has a fine grain structure, and is dense, hard, and tough. This material increases in ductility and strength up to red heat. It can be machined to accurate dimensions. It can also be welded with an oxy-acetylene torch, but it cannot be cut by this means, because of its high resistance to oxidation. This material takes a high permanent polish. Its other advantages are a high coefficient of expansion and a tensile strength of from 45,000 to 50,000 pounds per square inch. The hardness ranges from 250 to 270 Brinell.

Steel Sheets with Felt Bonded to Them

Sheets of steel with felted material bonded to one or both sides, in order to provide the properties of insulation, sound and vibration absorption, and cushioning are now available. Another advantage of this felt-bonded material is that the fibrous surfaces afford an anchorage for adhesives that may be used in applying other materials over the felt. The felt may be saturated with asphalt, oil, or resin to make it waterproof and corrosion-resistant.

Felt-bonded metal was developed by the Industrial Fellowship of the H. H. Robertson Co. at the Mellon Institute of Industrial Research, Pittsburgh, Pa. This material is being marketed by Felters Co. Inc., 210 South St., Boston, Mass. The felt is attached to the steel by utilizing a soft metal as an adhesive, this soft metal being applied by a hot dipping process. Before putting on the felt, the coated sheet is reheated until the soft metal becomes liquid. Then the fibrous layers of felt are rolled on the sheet. A rapid cooling operation solidifies the liquid metal, establishing an intimate bond between the felt and the steel base. This bond is of such a nature that it resists moisture and temperature up to the char point of the felt.

Drawing and forming operations can be performed without rupturing the bond. The material can also be corrugated, rolled into pipe form, and bent without detriment to the felt.

At the present time, 30- by 96-inch sheets of felt-bonded metal are being produced in Nos. 18 to 30 gage, inclusive, and 24- by 42-inch sheets in Nos. 31 to 34 gage, inclusive.

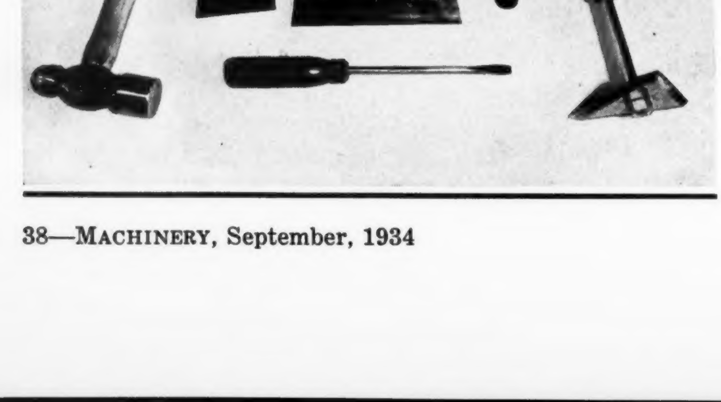
A Cold-Molded Heat-Resisting Plastic of Attractive Appearance

A cold-molded plastic compound intended especially for insulating applications in which parts must possess both good heat resistance and a fine appearance has been produced by the Plastics Department of the General Electric Co., Lynn, Mass. This Cetec No. 1389, as the compound is called, is therefore particularly well suited for use in making the heat-control knobs of electric irons, cord-connector plugs, etc.

Parts made from this compound are unaffected by temperatures up to 480 degrees F. They have a high dielectric strength and a transverse strength of 6000 pounds per square inch. Because the material is molded to shape at room temperature and then heat-treated to impart strength and toughness to the parts made from it, there is the added advantage of reduced mold investment.

Leaded Phosphor-Bronze Bars Made in Machine Lengths

Six-foot bars of Permite bronze, in all standard bearing bronze alloys, are now produced by Aluminum Industries, Inc., Cincinnati, Ohio. With tungsten-carbide tools, these bars can be machined at speeds in excess of 1500 surface feet a minute without using a coolant. The bars are supplied with a turned finish that facilitates gripping in chucks. They come in all sixteenth-inch sizes from 5/8 to 2 inches in diameter.



Non-sparking and Non-corroding Tools Manufactured by Stanley Tools, New Britain, Conn. These Tools are Made from Beryllium Copper. Edged Tools of This Material will Cut Tough Steel and Have a Long Life

NEW TRADE  LITERATURE

Recent Publications on Machine Shop Equipment, Unit Parts, and Materials. Copies can be Obtained by Writing Directly to the Manufacturer.

Gear-Lapping Machines

FELLOWS GEAR SHAPER Co., Springfield, Vt., is distributing a series of pamphlets on the Fellows gear-lapping machines. One of these pamphlets describes the three-lap recess type of gear-lapping machines; another, the hourglass worm type of helical-gear lapping machine; and a third, the No. 10LS recess type gear-lapping machine, with detachable internal lap head for spur gears. All three pamphlets describe in detail the principle of operation of the machines and contain complete specifications.

Welding Equipment

LINDE AIR PRODUCTS Co., 30 E. 42nd St., New York City. Booklet containing useful information on the design of jigs and fixtures for welding, whether it be production fabrication or repair work. The fundamentals of design are given and their influence on cost reduction is discussed. Clamping devices are described, with suggestions on how they are made. Locating points are discussed, and the control of heat effects on the jig from the blowpipe flame is treated at some length.

Monel Metal and Nickel

INTERNATIONAL NICKEL Co., INC., 67 Wall St., New York City. Booklet entitled "The Application of Monel Metal and Nickel to Industrial Processing Equipment." Besides complete tables on the various applications of these materials in industrial processing equipment, the booklet contains data on the physical and mechanical properties and miscellaneous information, including instructions on the selection of suitable welding rod and other details on fabrication.

Brass Die-Castings

DOEHLER DIE CASTING Co., Smead and Prospect Aves., Toledo, Ohio. Pamphlet entitled "Brass Die Castings with Strength of Steel," pointing out the advantages of these die-castings and describing three copper-base alloys which have been found to meet practically all commercial requirements. Illustrations show typical castings for which these alloys are applicable. A list of the physical properties of these alloys is also given.

Bakelite Bonded Abrasive Wheels

BAKELITE CORPORATION, 247 Park Ave., New York City. 24-page booklet entitled "High-speed Abrasive Wheels Bonded with Bakelite Resinoid." The booklet touches upon the historical phases of the abrasive industry and calls attention to the properties of Bakelite resinoids and their application in grinding wheel construction. Attention is also given to the uses for abrasive wheels bonded with phenol resinoid.

Electric Welding Equipment

LINCOLN ELECTRIC Co., Cleveland, Ohio. Application Sheet No. 39, in a series on the elements of design, discussing the welding of special shapes. The circular also illustrates the new Lincoln "Shield Arc" welder, and lists its outstanding features. Welder Specification bulletin No. 30, giving general specifications for alternating - current motor - driven Types SA 300, SA 400, and SA 600 "Shield Arc" welders.

Pneumatic Tools

INGERSOLL-RAND Co., 11 Broadway, New York City. Bulletin 2037-A, entitled "The World's Most Popular Pneumatic Tools," listing the company's new sizes of "Multi-Vane" drills, push-throttle screwdrivers and nut-setters. It also illustrates the Ingersoll-Rand pneumatic drills, grinders, riveters, chippers, rammers, wrenches, and hoists, and gives size and capacity tables for these tools.

Steel

UNION DRAWN STEEL Co., Massillon, Ohio. Bulletin pointing out the advantages of Union turned and ground precision shafting. Leaflet entitled "Better Parts Production with Union Free Cut," illustrating examples of parts on which the production has been materially increased by the use of Union "Free Cut" screw steel. Complete figures regarding the operation are given in each case.

Pyrometers

LEEDS & NORTHRUP Co., 4901 Stenton Ave., Philadelphia, Pa. Leaflets F-157 and F-163, illustrating and describing, respectively, Micromax recording controlling potentiometer pyrometers for controlling the temperature of furnaces, ovens, etc.; and Speedomax radiation pyrometers, designed for the rapid recording of steel temperatures during processing.

Portable Precision Grinders

DUMORE Co., 25 Sixteenth St., Racine, Wis. Catalogue describing the Dumore line of portable precision grinders and related products. In addition to the catalogue data, information is given on selecting the proper grinding wheel; relation of grain size to finish; arc of contact; wheel speeds; work speeds; using the diamond; and importance of balance.

Centrifugal Pumps

WORTHINGTON PUMP & MACHINERY CORPORATION, Harrison, N. J. Catalogue W-310-B4, containing tables of capacities, speeds, horsepower, and dimensions of Worthington centrifugal motor-driven and belt-driven pumps. Bulletin W-311-B1A containing specifications for Worthington single-stage volute type centrifugal pumps.

Electric Furnaces

HEVI DUTY ELECTRIC Co., Milwaukee, Wis. Bulletin HD-834, descrip-

tive of the new Hevi Duty high-temperature electric furnace of the tube type, which is designed chiefly for carbon determinations, but can also be used for standard combustions and heat-treating operations requireing temperatures of 1100 to 2300 degrees F.

Ball and Roller Bearings

BANTAM BALL BEARING CO., 3400 W. Sample St., South Bend, Ind., has just issued the Engineering Section of its complete anti-friction bearing catalogue. This section gives detailed illustrated information on the design, application, and lubrication of anti-friction bearings, as well as on the materials used and their heat-treatment.

Drilling Machines

BARNES DRILL CO., 814 Chestnut St., Rockford, Ill. Bulletin 126, illustrating and describing Barnes progressive production drilling units, which are made in various types to suit different classes of work. The special features of these machines are pointed out, the details are described, and specifications are included.

Blueprinting Equipment

F. A. SMITH MFG. CO., INC., Rochester, N. Y. Circular describing the important features and advantages of the "Speedway" blueprinter, a low-cost high-speed blueprinting machine. Other equipment illustrated includes complete cabinet blueprinting equipment, "Speedway" flat electrically heated print dryer, and supplies.

Roller Bearings

SHAFER BEARING CORPORATION, 6501 W. Grand Ave., Chicago, Ill. Catalogue 12, covering the Shafer line of self-aligning roller bearing units. In addition to complete specifications, information is given on the features of design, types, and selection. Several pages of illustrations show typical applications.

Strain Gages

BALDWIN-SOUTHWARK CORPORATION, Philadelphia, Pa. Bulletin 72, illustrating and describing a new type of scratch extensometer—a low-cost scratch-recording strain gage no larger than a latch key. Instructions are given for the use and care of this instrument, and typical record strips are reproduced.

V-Belt Drives

MEDART CO., St. Louis, Mo. Data and price list for Medart rope V-drives of 1/2 horsepower size and over. Information is also given on the selection of multiple V-belt drives, and tables of horsepower for various motor speeds, speed ratios and center distances are included.

Boring and Honing Machines

BARNES DRILL CO., 814 Chestnut St., Rockford, Ill. Bulletin 133, covering Barnes combination fine boring and honing machines. The pamphlet contains a general description of the machines, a description of the honing process, a list of applications, and specifications.

Air Conditioning

CLYDE R. PLACE, Graybar Bldg., New York City. Booklet entitled "Air Conditioning Planned and Proved," containing an explanation of the air conditioning industry from the standpoint of technical requirements, and the factors on which successful operation is based.

Conveyor Chains

WHITNEY MFG. CO., Hartford, Conn. Catalogue of Whitney conveyor chains, containing illustrations, general description, list of applications, and tables of dimensions and prices. Data is included on attachments and sprockets for use with Whitney chains.

Electric Equipment

ELECTRIC CONTROLLER & MFG. CO., 2700 E. 79th St., Cleveland, Ohio. Leaflet descriptive of the EC & M No. 1 Type ZO weather-proof dust-tight across-the-line motor starter. Leaflet illustrating and describing the new EC & M double-unit Type J push-button.

Small Tools

BROWN & SHARPE MFG. CO., Providence, R. I. Booklet listing the B & S line of tools, including micrometers, gages, and other measuring tools, arbors, clamps, index-plates, collets, die-holders, etc. Data are also given on geared pumps and motor pumps.

Photo-Electric Relays

WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, Pa. Catalogue Section 43-950, describing a new electric eye known as the Type LE photo-relay, which is applicable to all types of industrial control, light control, grading, counting, etc.

Precision Balances

ROLLER-SMITH CO., 233 Broadway, New York City. Catalogue 240, illustrating and describing the entire line of Roller-Smith precision balances for weighing and for determining surface tension, specific gravity, and many other values.

Electrical Measuring and Recording Instruments

LEEDS & NORTHRUP CO., 4901 Stenton Ave., Philadelphia, Pa. Bulletin F-156a. illustrating and describing the Micromax Model R single-point strip-chart recorder for indicating, signaling, and recording.

Research Microscopes

BAUSCH & LOMB OPTICAL CO., Rochester, N. Y. Catalogue D-129, descriptive of research microscopes and accessory equipment. A supplementary pamphlet gives price list and specifications for these microscopes.

Electric Drills, Grinders, and Buffers

STANDARD ELECTRICAL TOOL CO., 1938 W. 8th St., Cincinnati, Ohio. Catalogue 37, covering this company's line of electric drills, grinders, and buffing and polishing machines.

Air-Conditioning Equipment

GENERAL ELECTRIC CO., Schenectady, N. Y. Bulletin entitled "It's in the Air," dealing with the subject of air conditioning, and illustrating and describing air-conditioning equipment for industrial and home use.

Ball and Roller Bearings

GWILLIAM CO., 360 Furman St., Brooklyn, N. Y. Catalogue 11, covering the Gwilliam line of ball and roller bearings. Complete tables of specifications, including prices, are given for the various types.

Air Compressors

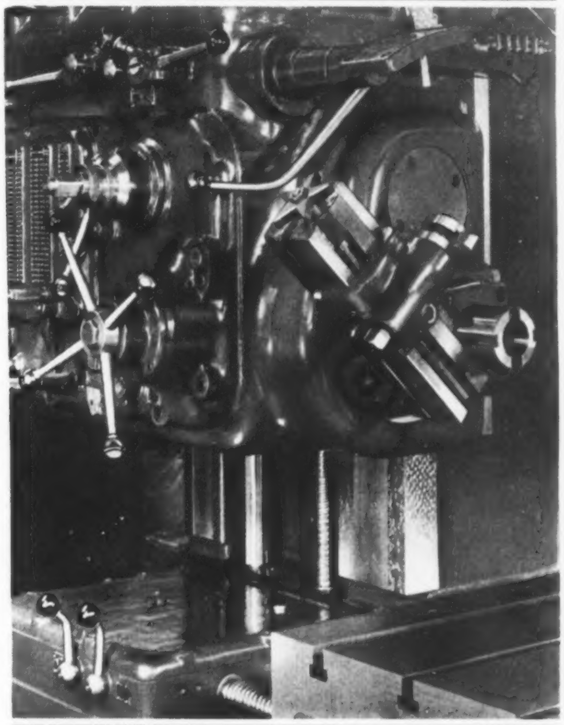
WORTHINGTON PUMP & MACHINERY CORPORATION, Harrison, N. J. Bulletin describing Worthington steam booster compressors, illustrated by views of typical installations.

Electric Generators

TROY ENGINE & MACHINE CO., Troy, Pa. Catalogue illustrating Troy-Engberg marine and stationary direct- and alternating-current generating sets.

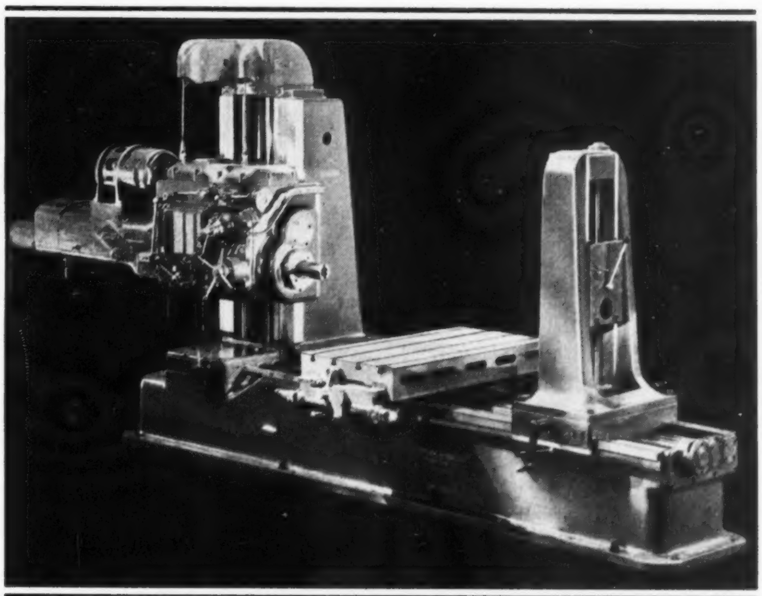
Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts and Material-Handling Appliances Recently Placed on the Market



Sellers Horizontal Boring, Drilling and Milling Machine

Heads of unit construction have been a feature of all the horizontal boring, drilling, and milling machines produced by William Sellers & Co., Inc., 1602 Hamilton St., Philadelphia, Pa., beginning with the first machine of this type which was built more than sixty years ago. In the No. 400 machine here illustrated, which is the latest development in the line of machines made by this concern, the unit head idea has been carried out to still greater advantage than in past designs.



Sellers No. 400 Horizontal Boring, Drilling, and Milling Machine

The motor for driving the complete machine is mounted on the head, so as to obtain the shortest drive to the spindle. Power is transmitted through short shafts and a minimum number of gears. Members of the drive unit are assembled on a plate that is fastened to the top of the head casting, while the complete feed unit is assembled on a plate that is mounted on the front of the head casting. Either unit can be readily dismantled from the head, if necessary, by merely removing a number of machine screws.

Complete control of this machine, including speeds, feeds, rapid traverses, starting, stopping, and reversing of the head, table, and saddle is provided through levers on the head. With this arrangement, all controls are always in the same relative position, regardless of the positions of the head or table. Hand adjustment of the various members can also be controlled from the head, micrometer dials enabling close settings to be made. Scales on the table and upright facilitate approximate settings. All shafts in the head run in anti-friction bearings, with the

exception of the spindle, which is carried in two large Nitralloy bushings at the front and back. The spindle sleeve runs in tapered roller bearings. The motor is of 10 horsepower rating.

Feeding of the spindle is accomplished through a lead-screw and rotating nut. Most standard threads from 1 to 20 per inch can be cut by merely using the lead-screw and nut, the remaining threads being obtained by changing pick-off gears. When the machine is to be used for operations in which tapping must be performed consistently to tool-room tolerances, the head can be provided with a second lead-screw for exclusive use in tapping operations. Instantaneous starting, stopping, and reversal of the spindle and its feed are effected by moving a single convenient lever. This feature is especially advantageous in tapping.

Safety stops and mechanical interlocks afford protection to the spindle, head, and table. Friction clutches in the feed, traverse, and drive mechanisms give added protection. Pressure lubrication is provided to all moving parts in the head. Other members that move intermittently, such as the table and saddle, are furnished with a central reservoir and a one-shot lubricating system.

Chip chutes at the rear of the bed aid in disposing of the chips. Self-equalizing table clamps are located in line with the spindle for clamping both sides of the table to the saddle ways. Similar clamps are provided for the saddle outside of the front and rear bed ways, so as to provide maximum leverage, irrespective of the table position.

Important specifications of the standard table type machine illustrated are as follows: Maximum traverse of the spindle, 60 inches (in two movements of 30 inches each); range of spindle speeds, 9 to 500 revolutions per minute; number of speed changes, 24; range of feed (each unit), from 0.0025 to 0.625 inch per spindle revolution; maximum distance from face of spindle sleeve to outboard support, 72 inches; vertical adjustment of head on column, 30 inches; minimum distance from top of table to center of spindle, 1 1/2 inches; size of table, 30 by 60 inches. A larger bed, column, table, etc., can be provided to increase the capacity of the machine.

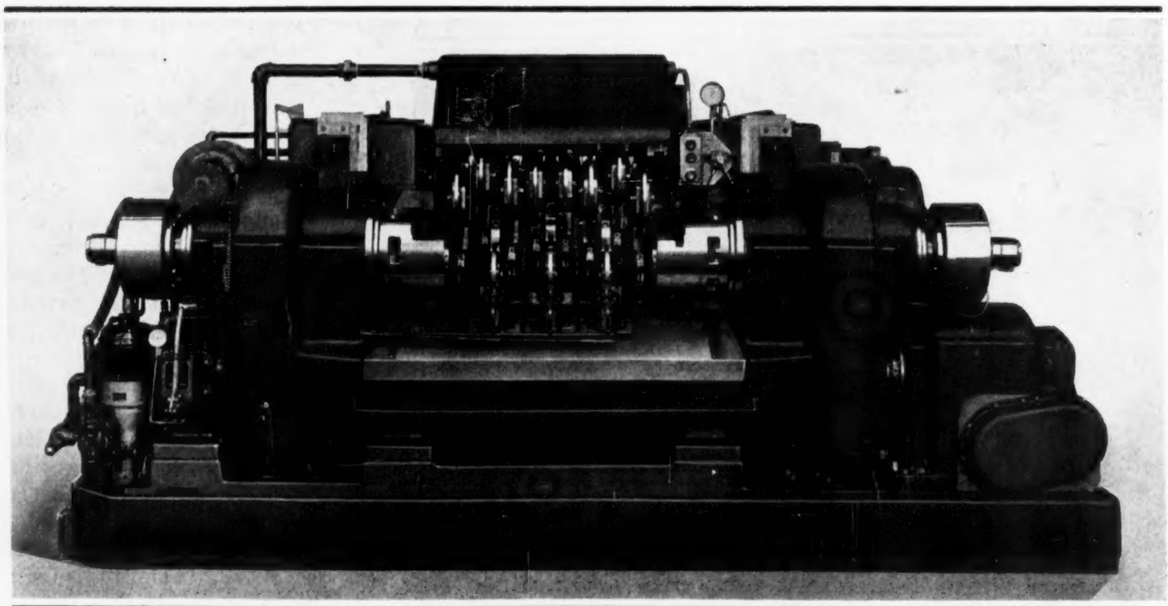
The heading illustration shows the machine equipped with a star-feed facing head that may be used for diameters up to 24 inches.

Melling Hydraulic Crankshaft Lathe

Hydraulic power is utilized on the latest Melling crankshaft lathe built by the Crankshaft Machine Co., Jackson, Mich., for operating the chucks and steadyrests. This machine was designed with a view to providing maximum rigidity and accuracy in simultaneously facing all cheeks and turning all pins of a crankshaft.

The spindles that carry the chucks are 6 inches in diameter and 29 inches long. Each spindle is mounted in three tapered roller bearings. The spindles are driven by continuous-tooth herringbone gears. All gears and bearings run in a bath of oil which is supplied from a tank in the base at a 25-pound pressure.

The machine is driven by a 60-horsepower direct-connected motor. Speed changes are obtained through a pair of gears in front of the speed-box. The table is mounted on trunnions and is rocked toward the main



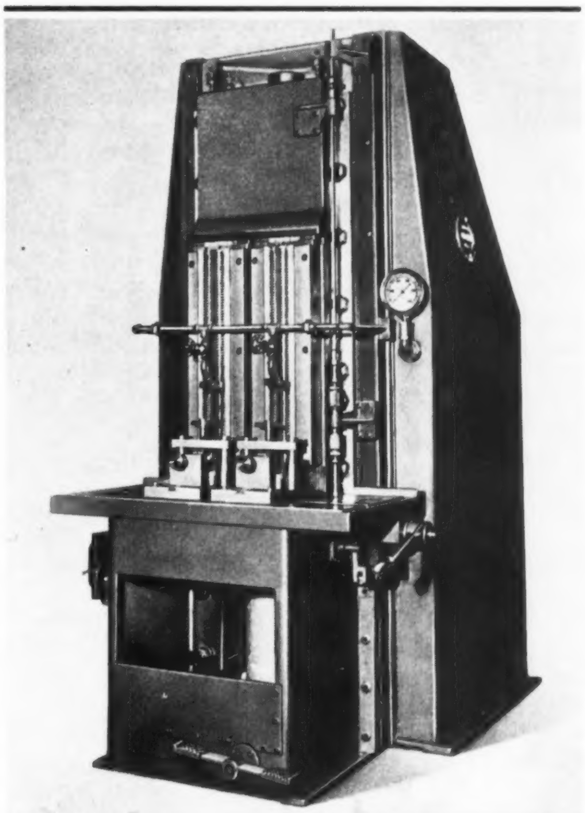
Melling Crankshaft Lathe Equipped with Hydraulically Operated Chucks and Steadyrests

housings by two arms during an operation.

After a crankshaft has been placed in the chucks and the steady-rest caps have been lowered, a small lever is moved to close the chucks, lock the steady-rests, and move the table into the cutting position. A button is then depressed to start the rotation of the spindles and the feeding action. The table now feeds toward the tools, the latter being mounted on large arms that carry a roller for steadying the cut. When the operation is finished, the motor stops, the table returns to the loading position, and the chucks stop in the correct position for removing the crank-shaft.

The pump that operates the chucks, steady-rests, and rapid-traverse cylinders is direct-connected to a five-horsepower motor, while the feed mechanism is driven by a one-horse-power motor. A 3/4-horsepower, built-in motor drives the coolant pump. The machine is 13 feet long, by 6 feet wide, by 6 feet high, and weighs 54,000 pounds.

Lapointe Hydraulic Surface Broaching Machines



Lapointe Surface Broaching Machine that can be Operated at Any Cutting Speed up to 24 Feet a Minute

Hydraulically operated surface broaching machines of the vertical design here illustrated are being introduced on the market by the Lapointe Machine Tool Co., Hudson, Mass., in 6-, 12-, and 20-ton capacities. Other sizes can be built to meet requirements.

These machines are of all-steel electric welded construction, except for the main pressure cylinder and the broach slide, both of which are semi-steel castings. The broach slide is guided on hardened and ground steel ways and is pulled downward on its working stroke so that the piston-rod is under tension during broaching. A West hydraulic pump built by the same concern operates the main ram of the machine.

The up and down strokes of the ram can be controlled by means of either the foot-pedal or the hand-lever. The foot-pedal control is intended for use in operating the machine on quantity production jobs. It is of the non-repeat type which insures safety of the operator. The machine can be so arranged that when the foot-pedal is depressed, the ram will make its down stroke, return to its upper position, and stop automatically. The hand-lever can be used to obtain the same cycle or it can be completely disengaged. However, it is necessary in setting the stroke and making new set-ups.

The speed of the ram is adjustable and readily controlled. The length of stroke is controlled by means of adjustment collars on the vertical shaft which is on the right-hand side of the machine. The minimum stroke is 2 1/2 inches, and the maximum 30 inches. Controls can be furnished, arranged for stopping at each end of the stroke or for continuous automatic cycling without stopping.

The electric driving motor, the hydraulic pump, and the coolant pump are all mounted inside the frame of the machine, which is made of comparatively light material, since it serves only as a housing. There is an inner housing on which the main cylinder, broach slide, ways for the broach slide, and platen are mounted. This housing is heavily constructed and well braced to take all of the load strains imposed upon it.

The broach slide is designed to permit the mounting of broaches of different widths and shapes. It is so machined that the broaches are always backed up against the thrust of the cut and thus there is no shear load on the screws that hold the broaches in place.

In the hydraulic system, the oil supply is above the main cylinder, pump, and all piping, so that air cannot accumulate in the system. The hydraulic pump is of the variable delivery type. Both the volume and direction of flow can be changed without the slightest shock. Because of its variable and reversible discharge, the pump may be rotated in one direction, irrespective of either the volume or the direction of flow. Cutting speeds up to 24 feet a minute are obtainable, the return speed being 60 feet a minute.

Barnes Drill Co.'s Hydram Drilling Machine

A heavy-duty hydraulic-feed drilling machine with a rated capacity for drilling 3 1/2-inch holes in solid S A E No. 1035 steel is the latest addition to the line of drilling machines built by the Barnes Drill Co., 814 Chestnut St., Rockford, Ill. The hydraulic ram which carries the spindle of this machine applies the feeding pressure directly over the center of the multiple head or the single cutting tool that is being used. The large cylinder and ram permit the use of a short saddle on the column, since the saddle takes only the torque of the drive shaft.

Power is delivered to the cutting tool with minimum torsional vibration, being transmitted directly from the vertical drive shaft to the comparatively short spindle of large diameter through a gear-case that is carried on the nose of the ram. Unusual rigidity of the sleeve or ram is a feature of the machine, the ram being of equal length on each side of the piston, so that it is well supported during the entire spindle travel. The hydraulic unit is of wide versatility as to spindle travel, interchangeability of multiple heads, and vertical, horizontal, or angular application.

By special adaptation, the Hydram unit can be arranged for cylinder boring and also for independent use as a drilling head on any type of machine equipped with a hydraulic pump. As a separate drill head, the unit can be used vertically, horizontally, or at an angle.

The illustrations show this machine fitted with a nine-spindle auxiliary head for drilling the master connecting-rod of an aircraft engine in one set-up. Interchangeable fixtures have been provided so that the same machine can be used for boring and final reaming operations on the same part. The tools are guided above and below the work.

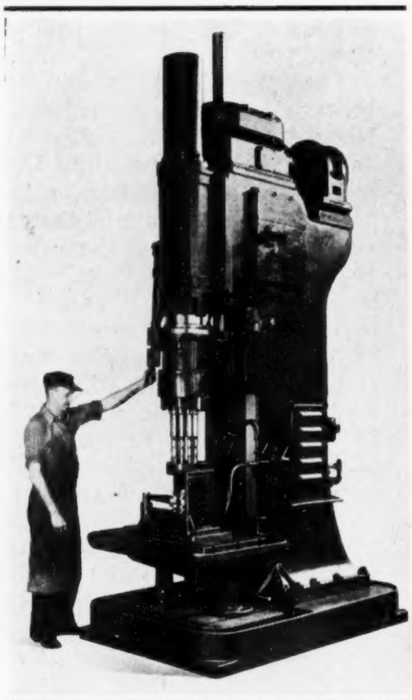


Fig. 1. Hydram Heavy-duty Drilling Machine

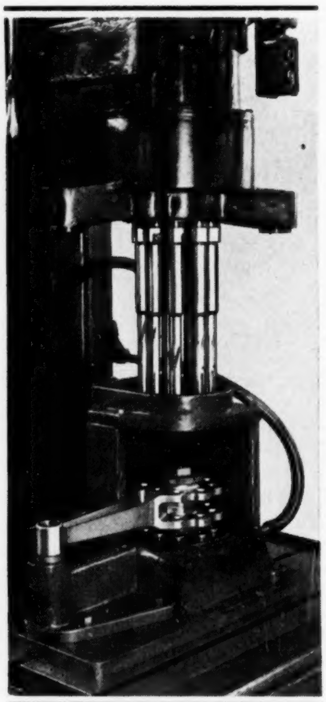


Fig. 2. Drilling an Airplane Master Connecting-rod

Cincinnati Hydro-Broach Machines

Hydraulically operated duplex vertical broaching machines are now being offered to users of high-production equipment by the Cincinnati Milling Machine Co., Cincinnati, Ohio. These broaching machines are intended for surface or external broaching. They are built in three sizes, of 2, 5, and 10 tons capacity. Normal maximum strokes of 36, 42, and 54 inches, respectively, can be provided, and extended maximum strokes of 48, 54, and 66 inches.

Broaches up to 32 inches long can be used in the two-ton 36-inch stroke machine and up to 62 inches long in the ten-ton 66-inch stroke machine. Various ram speeds can be provided, depending upon the pump and motor. The machines weigh from 10,000 to 18,000 pounds.

Nine principal advantages are pointed out for these broaching machines, including an unusually fast cycle; completely hydraulic operation; continuous operation with an automatically indexed work-table; simple, rigid construction; long tool life; convenient working height; automatic lubrication; high degree of accuracy; and simplicity of work-holding fixtures.

Each of the two broaching tools used in one of these machines is backed up by a heavy ram which slides in guide-ways on a vertical column. This provides a rigid support for the tool, eliminating vibration and contributing to long tool life. Tool life is further increased by the cushioning effect of the hydraulic pressure that moves the broach ram. The broaching tools are fastened to the rams.

The columns that carry the rams are mounted on a large base which contains reservoirs for cutting coolant and the oil used by the hydraulic system. One ram goes up while the other comes down, and so there is but one broaching tool in cutting action at a time. The indexing table is mounted at a height convenient for an average-size operator standing on the platform at the front of the machine base.

Indexing of the table is controlled by a hydraulic mechanism that is interlocked with the operation of the vertical rams. The broach on the descending ram engages work in the fixture which has been indexed to the cutting position, while the fixture on the opposite side of the table has been indexed to clear the broach on the ascending ram.

Upon the completion of the cutting stroke of one ram and the return stroke of the other, both rams stop, the work-table indexes, the rams reverse their direction of movement, and the cycle of operation repeats itself. Practically continuous production is obtained because the indexing time is small and the operator replaces work in one fixture while work in the other fixture is being broached. The work-table indexes on hardened and ground plates supported by the heavy fixed knee.

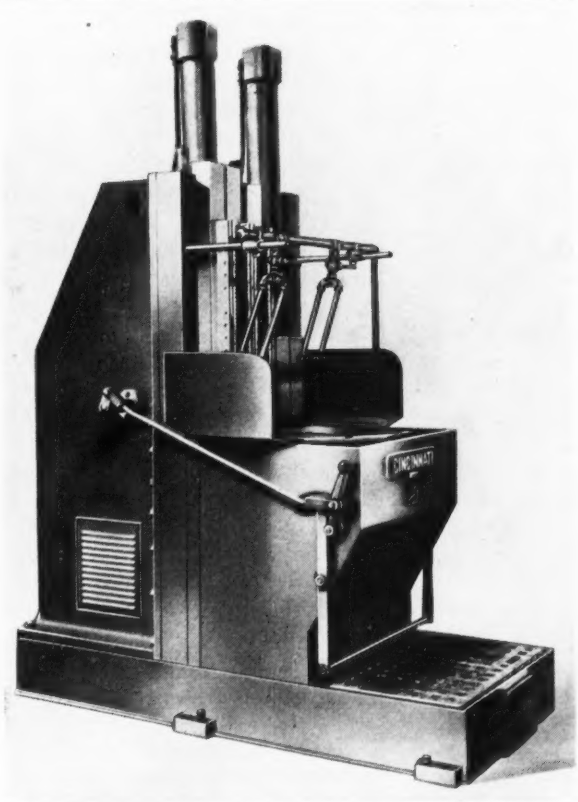
The automatic cycle is a pace-setter for the operator. If he finds that he cannot keep up with the machine, the machine can be stopped immediately by kicking the treadle-bar with either foot and from any position on the platform. The ram movement may be reversed if desired after stoppage by exerting pressure on one of the hand-levers located on both sides of the knee.

The table indexing mechanism is simple in design, being based on the Geneva principle. The table is accelerated and decelerated during indexing without any noticeable shock by means of hydraulic pressure. The ram slides are also actuated hydraulically. Hydraulic pressure is supplied by a standard hydraulic pump that is directly connected by a flange coupling to a constant-speed motor.

An automatic lubricating system insures long life and low maintenance costs for the wearing surfaces of the ram ways, table bearing, and indexing mechanism. The valve mechanism and the hydraulic pump are self-oiled. A motor-driven pump having a capacity of 20 gallons a minute supplies the coolant to the broaches.

Gorton Duplicating Machines

A line of machines recently developed by the George Gorton Machine Co., 1109 Thirteenth St., Racine, Wis., provides a new method of duplicating small dies, such as are used in the production of die-castings or small drop-forgings and molds used in the rubber, glass, plastics, and similar industries. These duplicating machines are manually operated. They consist primarily of Gorton vertical millers, equipped with a tracing arm at the right of the cutter-spindle and a special table mounted on



Cincinnati Duplex Hydro-broach Machine of Five Tons Capacity

Fig. 1. Gorton Milling Machine Equipped for Duplicating Small Dies and Molds

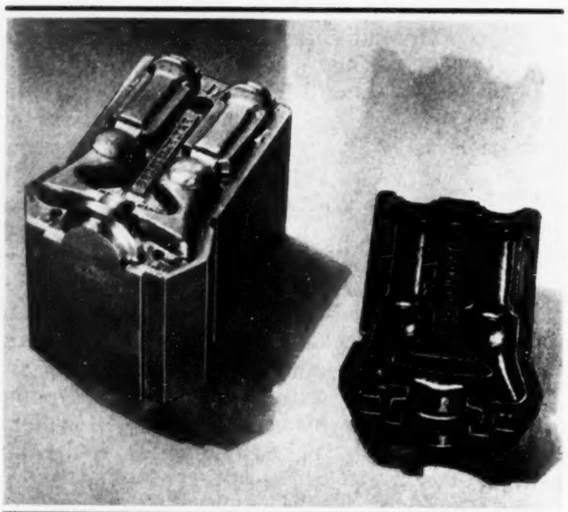
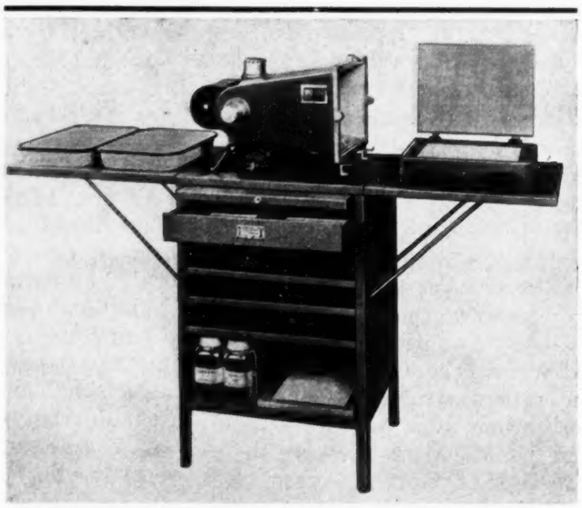


Fig. 2. Mold Part and the Plastic Part from which it was Reproduced



Speedway Blueprinting Outfit, Complete with Printer and Dryer

top of the standard milling machine table. The special table operates on compound ball-bearing slides.

With his left hand, the operator controls the movement of both the milling-cutter and tracer spindles, raising or lowering them as the tracer point follows the contours of the master or die that is being reproduced. With his right hand, the operator moves the duplicator table horizontally in any direction, causing the cutter to mill the die as the tracer follows the shape of the master. The master may be an actual working die or a piece made of brass, Bakelite, fusible alloy, or plastic material.

Masters can be reproduced by this method within limits of 0.001 inch or closer. The master table is provided with built-in micrometers for accurately shifting the die during the process of reproduction, should slight changes in the position of various sections be desirable on the new die. Similarly, portions of several masters can be combined in a new die or sections can be left off entirely. Holes for ejector pins, etc., can be located from an old die and spotted for drilling, thus eliminating a jig-boring operation.

Spindle speeds up to 12,000 revolutions per minute are obtainable, thus permitting the use of cutters as small as 0.025 inch in diameter for fine accurate work. When roughing out dies, the duplicator table can be locked and the necessary movement obtained with the milling machine table. In such work, cutters with a shank up to 1/2 inch in diameter can be used. The duplicator head and table are detachable within five minutes.

GE Alternating-Current Arc-Welding Equipment

A complete line of alternating-current arc-welding equipment, including transformer units, electrodes, and automatic welding heads and control, has been brought out by the General Electric Co., Schenectady, N. Y., to supplement its line of direct-current arc-welding equipment. The new welding equipment is intended primarily for automatic welding, but it can be used in hand applications.

The major advantage claimed for the alternating-current process is the absence of magnetic blow in the arc, thus permitting welds of high quality to be obtained. This advantage is particularly apparent with currents above 250 amperes. The transformer units are available in sizes having one-hour ratings of 500, 750, and 1000 amperes.

Speedway Blueprinter

Blueprints up to 9 by 12 inches can be made rapidly with a Speedway blueprinting outfit which is being introduced on the market by the F. A. Smith Mfg. Co., Inc., 187-189 N. Water St., Rochester, N. Y. The illustration shows the complete equipment. The printer and dryer can be obtained without the cabinet if desired.

The cabinet is of all-steel construction and is finished in dark maroon. It is provided with side leaves that are easily raised or lowered. The drawer has a twin compartment for tracings and blueprint paper. There is also a handy pull-out shelf on which the blueprint frame may be supported when changing prints and tracings.

This outfit operates on either direct or alternating current. A set of carbons lasts for approximately 200 prints. An automatic timing device rings a bell when a print has been exposed for a predetermined length of time. The dryer consists of a chromium-plated platen that is reinforced with a heavy aluminum heat-distributing plate. This plate heats evenly over its entire surface and thus produces flat prints. The presser is fitted with a moisture-absorbing pad that facilitates drying.

Huge Bliss-Marquette Presses of Welded Construction

Two automobile-frame side rails can be formed from 5/32-inch sheet steel, or one truck side rail from 1/4-inch stock, at each stroke of the mammoth press shown in Fig. 1. This machine, which was recently built by the E. W. Bliss Co., 1420 Hastings St., Toledo, Ohio, is the largest press of welded construction ever built. It is 21 feet wide between housings, and the bed measures 68 inches from front to back. The slide has a stroke of 16 inches and it operates at the rate of seven strokes a minute. The working capacity is 1800 tons plus 300 tons for the drawing cushions, while the complete weight is 750,000 pounds. The welding of this machine was done by the Westinghouse Electric & Mfg. Co.

The press illustrated in Fig. 2 is another recent machine, of double-eccentric type. This press has a rating of 1200 tons and a stroke of 18 inches at the rate of ten strokes a minute. The bed area is 148 by 50 inches. The welded members of this press were fabricated by Lukenweld, Inc. A fast-acting pneumatic friction clutch equipped with simplified electric control provides an unusually convenient operation. Freedom from maintenance costs is obtained, as the clutch is self-adjusting over a wide range.

Both of the presses here shown are designed with short shafts running from front to back to eliminate torsional strains. The beds are equipped with hydro-pneumatic drawing cushions made by the Marquette Tool & Mfg. Co., also of Toledo. These drawing cushions are provided with automatically timed locking devices. Marquette air-counter-balanced cylinders are furnished at the four corners of each slide.

A saving in weight and a reduction in the possibility of fatigue failure due to overloading are advantages claimed for the welded steel-plate construction of these presses. All welded members are annealed to eliminate internal strains due to local temperature differences and parallel welds.

Electric-Weld Stress Reliever

Equipment for relieving the stresses in electrically welded pipe from 6 to 24 inches in diameter is being placed on the market by the Detroit Electric Furnace Co., 825 W. Elizabeth St., Detroit, Mich. The equipment has been designed primarily for normalizing welded joints in pressure piping systems and it is especially suitable for field operation. Jointed rings of various sizes are provided to fit the pipes. Power is supplied for a special transformer which is mounted on a hand truck, together with the necessary control equipment to facilitate field use. Inducted heat is applied to the areas to be relieved, in accordance with predetermined values.

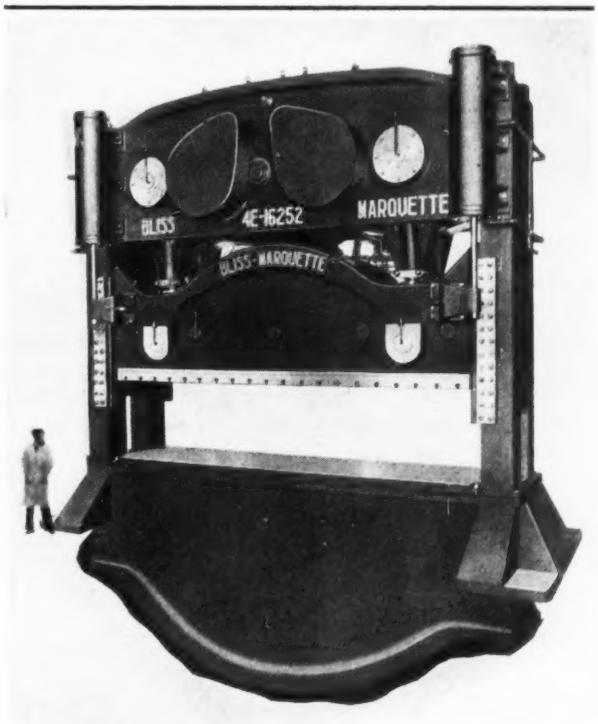


Fig. 1. The Largest Press of Welded Construction Ever Built—It Measures 21 Feet between Housings

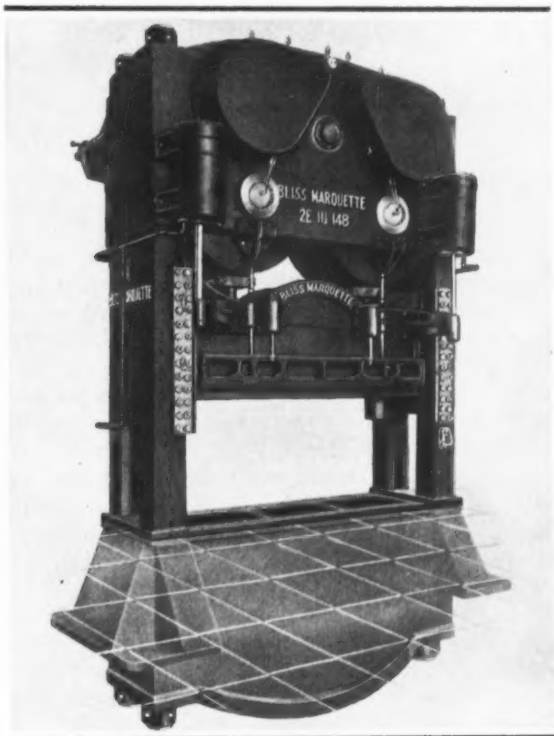


Fig. 2. Another Bliss-Marquette Press Equipped with Hydro-pneumatic Drawing Cushions

Heald Double-End Bore-Matic

A double-end Bore-Matic has been designed by the Heald Machine Co., Worcester, Mass., for the mass production either of individual parts on which one or more operations are to be performed or of different pieces that can be handled at a single setting. This machine weighs approximately 5 tons, the massiveness of the construction alone absorbing practically all normal vibration. However, additional care has been taken to prevent the transmission of vibration to the boring spindles or the work. For example, vibration dampeners are supplied under the main-drive motor and pump, a flexible connection is used between the pump and the hydraulic system, and multiple V-belts are used.

Four boring heads can be mounted on the bridges of this machine. The boring heads are driven from clutch and brake units by means of multiple V-belts. Boring speeds from 360 to 3270 revolutions per minute are obtainable by simply changing pulleys. Buttons on the bridges serve as locating points for the boring heads.

The standard distance between the bridges is 33 inches, and the maximum table travel 14 inches. The boring stroke at one end of the machine may be as much as 8 1/4 inches, but there cannot be more than a total of 13 inches at both ends of the standard machine. While this gives plenty of room for the usual run of fixtures and work, bridge spacings up to 42 inches can be obtained by mounting the bridges farther back on each end. By this means, a maximum total stroke of 22 inches can be obtained.

The clutch and brake units for starting and stopping the boring heads are of the hydraulic self-adjusting type. Direct-acting oil pressure automatically takes up all wear of these units, provides ample lubrication, and insures smooth starting and stopping. A braking action is maintained on the heads when they are idle. This allows ready adjustment of the tools and jogging of the heads by the hand manipulation of a clutch knob.

The operating controls for the entire machine are located within a small radius on the front of the base. The main control unit is built up of separate units for the various functions of the machine, so that changes in the operating cycle can be readily made without disturbing any piping. To change from one cycle to another requires only the substitution of simple parts.

A neutral position of the reversing valve allows drifting of the table against a positive stop for facing. The boring heads are stopped with sufficient allowance for cleaning up a facing cut. Thus the tools are not allowed to idle in contact with the finished work, which would tend to dull their edges. The timing or dwell of the table and heads is controlled by means of knobs on the reversing valve.

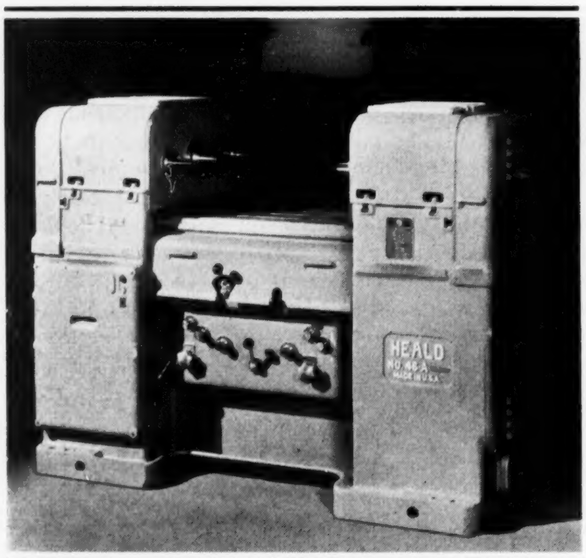


Fig. 1. Double-end Bore-Matic which can be Furnished with Four Heads on Each Bridge

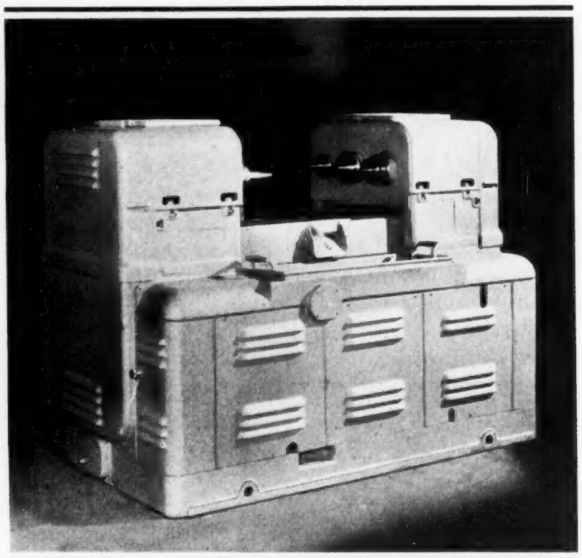


Fig. 2. Pleasing Lines are Obtained at the Rear by Means of Ventilated Panel-type Guards

Should it be desired to set up this Bore-Matic as a single-end machine with either a short or a long stroke, an intermediate stop valve can be set to stop the table for loading just inside the outer reversing point, or dog adjustments can be made to secure a positive stop without reversal of the table in the outer position.

The boring heads are of a solid one-piece body type. They are ball-bearing equipped and are free from vibration. The standard head has a spindle provided with a large flange to which a quill is bolted for carrying the boring tool. Graduations facilitate accurate settings of

the tool. Holes as large as 6 1/8 inches in diameter approximately, and as small as 1/4 inch can be bored in this machine. The table feeds range from 1 to 15 inches per minute, while the maximum rapid traverse of the table is 20 feet per minute.

Landis Hydraulic External Race Grinder

External races of anti-friction bearings can be ground in the 5-inch machine here illustrated, which has recently been brought out by the Landis Tool Co., Waynesboro, Pa., as a companion machine to the 3 1/2-inch hydraulic internal race grinder described in April MACHINERY, page 495. Like the internal race grinder, the new machine has a capacity for the races of all the smaller sizes of ball bearings up to and including the Nos. 218, 316, and 414 groups. Although ordinarily used for single-row races only, the grinder can also be used for double-row races and thrust races. Larger sizes of races can be handled by removing the sizing device and certain other parts of the machine and then operating the machine by hand.

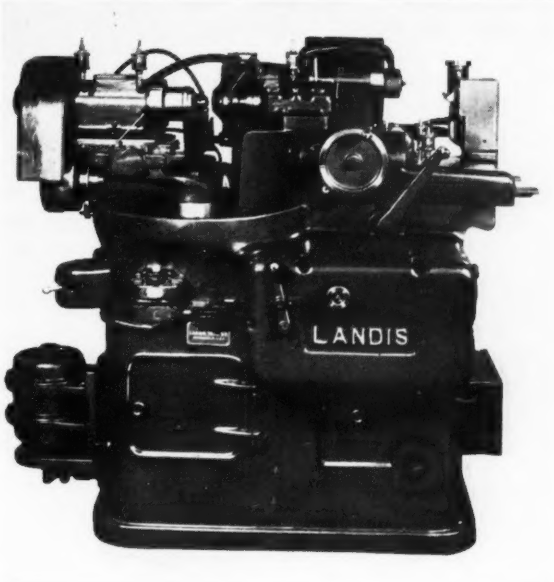


Fig. 1. Landis Machine for Grinding the External Races of Anti-friction Bearings

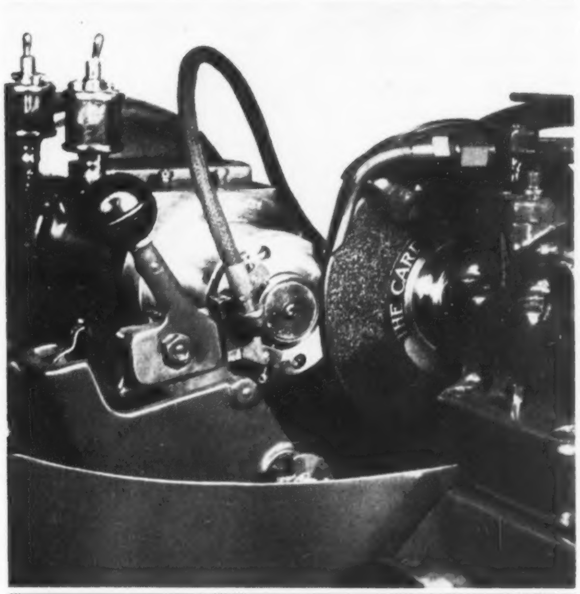


Fig. 2. The Landis-Solex Sizing Device Enables Grinding to within 0.0005 Inch

Various machine movements take place automatically. These automatic movements are controlled through the progress of the grinding by a Landis-Solex sizing device. The operator places a race on the chuck and then starts the rotation of the work. The work-head immediately begins oscillating and the wheel then automatically feeds at a rapid rate into grinding contact with the race. The hydraulic feed mechanism now comes into play for feeding the wheel at a predetermined roughing rate.

When the work has been rough-ground to within about 0.001 inch of the finish size, the amount being adjustable, the feed is automatically changed to a very fine finishing rate. If desired, the coolant can be automatically cut off at this point for a dry finishing operation. When the race reaches the finish size, the wheel automatically backs away and the oscillation of the work-head stops. The operator then stops the rotation of the work, swings the sizing device back to its inoperative position, and reloads the machine.

With few exceptions, this hydraulic external race grinder is designed and proportioned like the internal race grinder. However, because the grinding wheel is larger, the wheel-spindles and bearings are more generously proportioned. The principal feature of the machine is the sizing device, which permits the consistent production of races within limits of less than 0.0005 inch.

A chatter-free finish is claimed as a result of the use of hydraulic power and the elimination of vibration between the grinding wheel and the work by mounting both electric motors low on the bed. The rear drive motor is coupled direct to the oil and coolant pumps and is belted to the wheel-drive jack-shaft. This jack-shaft and all idlers are mounted on the bed, so that vibration will not be transmitted to the wheel-base, the design thus insulating all rapidly rotating members from the wheel.

The illustrations show the machine equipped with a magnetic work-holding chuck, but other types of chucks can be supplied.

Ingersoll Boring Machine for Camshaft and Crankshaft Bearing Holes

Camshaft and crankshaft bearing holes in automobile cylinder blocks can be bored at the rate of ninety blocks an hour by means of a machine recently developed by the Ingersoll Milling Machine Co., Rockford, Ill., which employs stub type boring tools. This machine is used in batteries of three for performing roughing, semi-finishing, and finishing operations successively on the bearing holes. The three machines can be operated individually or they can be tied together with an automatic transfer conveyor.

The arrangement of the boring tools may be seen in Fig. 1. It is stated that alignment can be consistently maintained in high-production operations by employing stub tools mounted on a long heavy slide above the work as shown, because this construction gives a bearing area from ten to fifteen times that possible with the conventional boring-bar. High rates of production are obtained because of the short bar travel and the easy loading and positioning of the work.

Multiple-blade cutters can be used, and the construction of the tools is sufficiently rigid to permit employing the harder cutting materials. The conventional tolerances specified for hole sizes and roundness in reaming operations can be maintained in boring operations with this machine. Another advantage derived from the small travel of the stub boring tools is that the floor space is reduced to one-third that usually required.

Milwaukee Automatic Milling Machine

The Milwaukee Simplex and Duplex bed type milling machines which were described in December, 1930, MACHINERY, page 307, at the time that they were introduced on the market by the Kearney & Trecker Corporation, Milwaukee, Wis., are now provided with a complete two-way automatic control. With this new feature, the table can be operated either automatically or manually, or by a combination of both methods. To provide completely automatic control, a compact hydraulic unit has been incorporated in the saddle. This unit permits a great variety of milling cycles, both one- and two-way, with or without an automatic spindle stop.

Two plungers at the left and right of the tripping post control the operation of the unit for the automatic reversal of the table and its rapid return. At the point selected for automatic reversal, a dog depresses a plunger which opens a valve slightly, causing the plunger to jump ahead under hydraulic pressure. The entire operation of reversal is then effected hydraulically at a fast constant rate, regardless of the load. The point of reversal is controlled to a fine degree of accuracy. On previous machines, the clutch was withdrawn me-

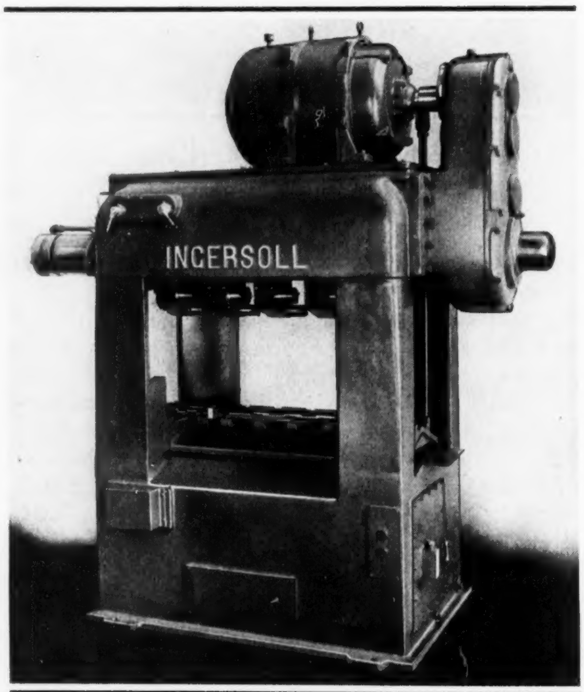


Fig. 1. Ingersoll Machine which Employs Stub Tools for Boring Camshaft and Crankshaft Bearing Holes in Cylinder Blocks

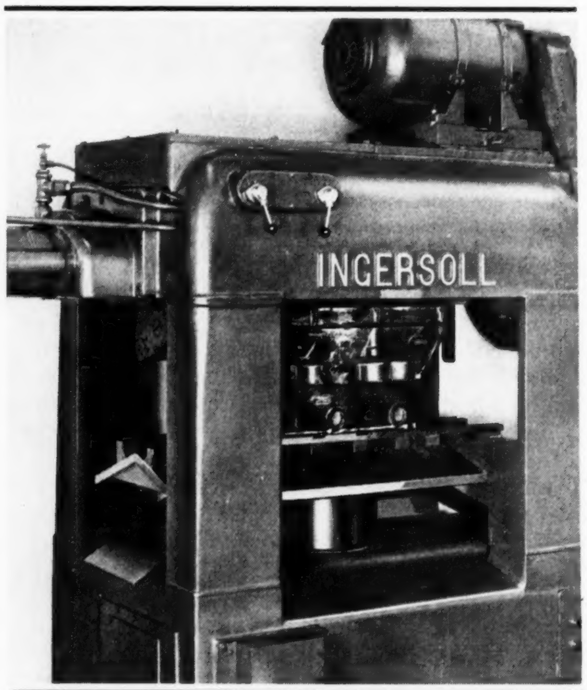


Fig. 2. Close-up View of the Machine in Fig. 1 with an Automobile Cylinder Block in Place for the Boring Operation

Milwaukee Bed Type Milling Machine Equipped for Completely Automatic Operation

Landis Pipe Threading and Cutting-off Machine with a Capacity of from 1/4 to 2 Inches

chanically at the feed-rate speed. This slow withdrawal of the clutch subjected it to severe strain and limited the accuracy of the reversing point. The automatic reversal is always followed by an instantaneous shift to rapid traverse.

The table dogs and tripping mechanism are fully enclosed in a compartment in the side of the table. A sliding cover makes the dogs readily accessible and yet eliminates all dirt, chips, and coolant. A small lever on the front of the machine enables the operator to select the automatic spindle stop or the conventional control, whichever is preferred for the job on hand.

The rapid traverse, feed, and direction of table movement are controlled by a single lever, also on the front of the bed. A third lever engages and disengages the main clutch.

Three feed ranges are available on this machine, namely, from 1 1/2 to 20, 1 to 40, and 2 1/2 to 100 inches per minute. There are eighteen changes in each range. Four speed ranges are available as follows: 20 to 135, 40 to 270, 75 to 500, and 150 to 1000 revolutions per minute. Ten speed changes are provided in each range.

"Little Landis" Pipe Threading and Cutting-off Machine

Two die-heads having a combined capacity of from 1/4 to 2 inches are furnished as standard equipment on a "Little Landis" pipe threading and cutting-off machine being introduced on the market by the Landis Machine Co., Inc., Waynesboro, Pa. This is the only pipe machine of portable or semi-portable type that employs the Landis die-head and "Long Life" patented chaser. The machine is of the lathe type, in which the work is revolved. It is designed to thread, ream, and cut off pipe and to thread bolts, rods, etc. The features stressed by the manufacturer include light weight, quick set-up changes, economical operation, and moderate price.

The machine is made in a motor-driven type only. It is driven by a one-horsepower motor which is enclosed in the bed and connected to the geared headstock by means of a silent chain. Three speed changes are available through the gear-box, which is cast integral with the spindle housing, thus providing unusual rigidity.

The cross-rail which supports the die-head and the cutting-off and reaming tools is integral with the carriage. A scroll chuck of the three-jaw universal type is employed. The die-heads are of a new design that combines light weight with rigidity and strength. The heads are of the quick-opening type and have a universal adjustment for size. By applying bolt chaser holders, the 2-inch head can be used for threading bolts from 3/8 to 1 1/4 inches. The setting of the chasers in their holders remains constant for all diameters.

The chasers are of the tangential type employed in the standard line of die-heads and machines made by the same concern. Owing to their light weight, the die-heads can be readily handled, thus facilitating changes in set-ups when the die-heads must be interchanged.

Portable Ventilator for Welding Operations

The Coppus Engineering Corporation, Worcester, Mass., has developed a portable ventilator for carrying off welding fumes from enclosed compartments. The

equipment was especially designed for use in shipyards where much welding is done in enclosed spaces, but it is equally applicable in welding tanks or drums or wherever there is a problem in getting rid of welding fumes.

The ventilator can be lowered through a 14-inch diameter opening. Its total weight, including the electric motor, is only 80 pounds. An 8-inch flexible tubing carries off fumes and foul air at the rate of 1500 cubic feet a minute.

Etna Redesigned Swaging Machines

Important improvements have been made in the construction of the swaging machines built by the Etna Machine Co., 3400 Maplewood Ave., Toledo, Ohio. The head is now provided with a heavy steel band which is shrunk on the outside to set up a contracting force that balances the swaging load. The head is also more heavily constructed than before. It is equipped with a spindle that is hardened and ground all over. The spindle is mounted in two Timken bearings and a radial ball bearing which is mounted in the rear of the flywheel. Oil is circulated through the head from a tank in the base. This lubricating system is required in certain classes of swaging only.

The machine is driven by a motor mounted in the base on a bracket that is adjustable from the side of the machine to produce the proper tension in the Texrope belts which drive the machine. A starter is mounted on the machine and wired to the motor ready for operation when lead wires are connected to it. A guard for the flywheel and the belts provides protection for the operator.

These redesigned swaging machines are built in sizes which have capacity for work from 3/8 inch to 6 inches in diameter. Dies from 1 to 18 inches long can be supplied. Two- and four-die types of machines can be built, in addition to the style illustrated.

Niagara Inclinable Power Press

A No. A 3 1/2 inclinable power press recently added to the line of the Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y., is shown in the accompanying illustration. The frame of this press is a semi-steel casting, the sections of which have been proportioned to obtain maximum strength and rigidity for the weight, and to so distribute the metal as to insure a solid casting with minimum internal strain. The main bearings in the frame are tied together by webs and are so constructed that the pressure from the crankshaft is transmitted directly to the frame. This construction insures accurate align-

Etna Swaging Machine Made in Various Sizes for Work from 3/8 Inch to 6 Inches Diameter

Inclinable Power Press which has Recently been Added to the Niagara Line

ment and proper lubrication of the bearings.

On geared machines, a tube in which the anti-friction bearing back-shaft is mounted is assembled in accurately bored openings in the frame which are positively aligned with the crankshaft. This tube forms a sealed lubricant reservoir for the anti-friction bearings.

The press is built with a Niagara improved pin-type clutch which has four engaging points, a positive stop that prevents repeating, and an indicating arrangement on the brake that shows when proper adjustment and operation have been obtained. The motor drive bracket is bolted to machined pads on top of the frame. This location places the center of gravity near the middle of the machine and facilitates the inclining or raising of the frame.

Motor Drive Unit for Pratt & Whitney Bench Lathe

A motor drive unit, complete with a two-speed gear-box, has been brought out by the Pratt & Whitney Co., Hartford, Conn., for application to the bench lathe of its manufacture. With a slightly different pulley arrangement, the same motor drive is applicable to the universal bench miller made by the concern.

In this new drive, the motor is mounted beneath the bench as shown in Fig. 1, on a hinged platform which can be adjusted to tighten the driving belt. The belt passes up through a slot in the bench to a driving pulley inside the unit. Power is delivered from the driving pulley through a two-speed gear-box to a three-step cone pulley which corresponds to the one on the headstock of the lathe.

The entire unit is ball-bearing mounted and is equipped with hardened and ground gears that run in oil. A lever on the front of the unit engages either the low- or the high-speed range. There is also a neutral position. A swinging idler attached to the side of the unit (not shown in Fig. 1) maintains the proper tension in the belt that connects the two cone pulleys. With a 1/2-horsepower motor running at 1800 revolutions per minute, six spindle speeds ranging from 145 to 1400 revolutions per minute are available.

When a high-speed drive is desired to permit the use of grinding attachments, the top cover of the motor drive unit is replaced by a long bracket and jack-shaft, as in the case of the machine mounted on the left-hand end of the bench in Fig. 2. An extra pulley is placed on the shaft with the three-step cone pulley for driving the jack-shaft. The jack-shaft, in turn, drives the high-speed grinding spindle through a small round belt. The jack-shaft speeds are 410 and 1640 revolutions per minute.

A bench miller with the new motor drive is shown at the right of the bench in Fig. 2.

Perliton—a Liquid Carburizer

A liquid known as Perliton is being introduced on the market by E. F. Houghton & Co., 240 W.

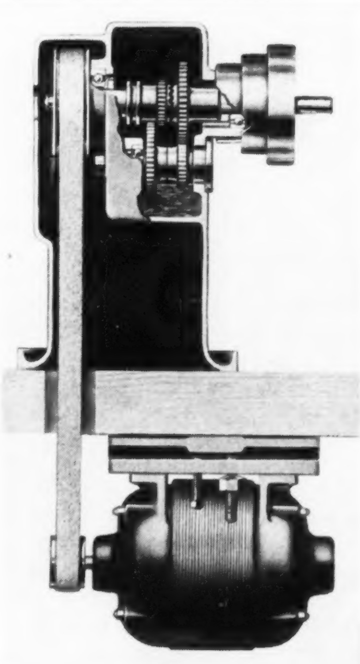


Fig. 1. P & W Motor Drive with Two-speed Gear-box

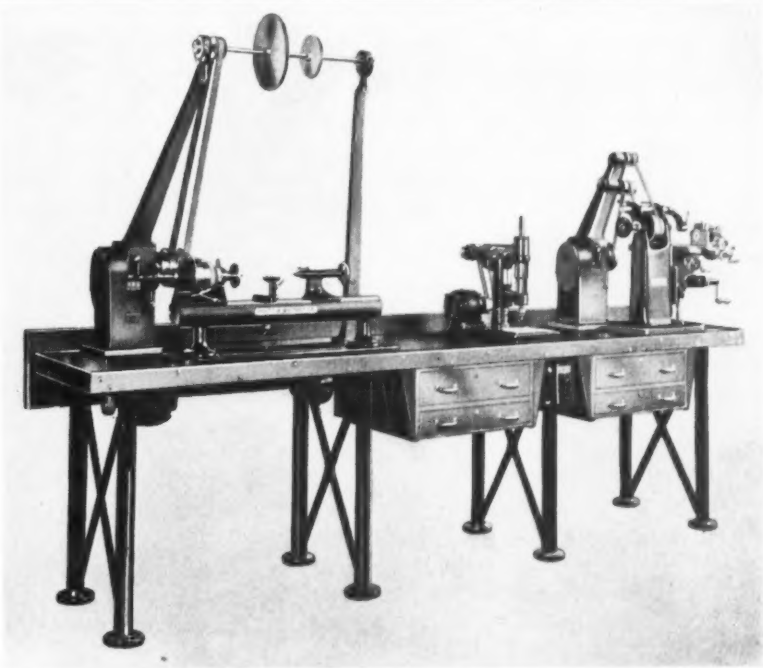
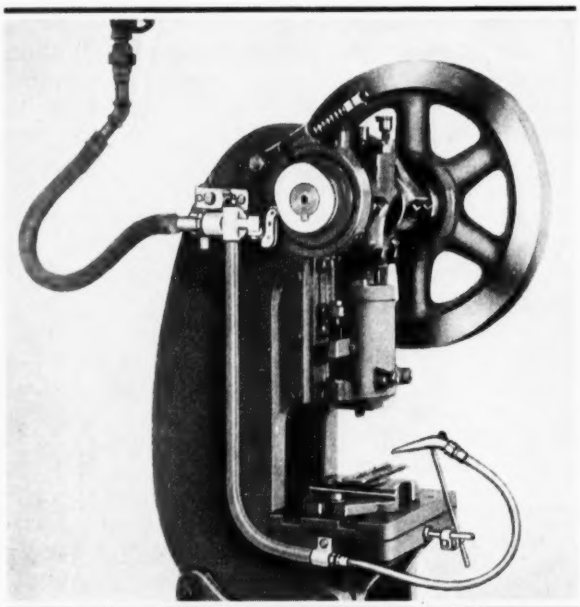
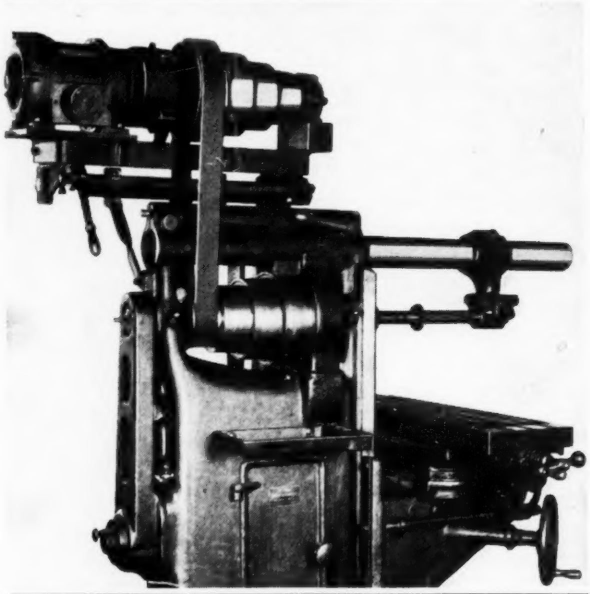


Fig. 2. Pratt & Whitney Bench Lathe and Universal Miller (Left- and Right-hand Ends, Respectively) Equipped with New Motor Drive



Punch Press Equipped with the Littell Air Valve and a Nozzle for Blowing Work from the Die



Milling Machine Provided with Motorized Countershaft Made by the Production Equipment Co.

Somerset St., Philadelphia, Pa., for carburizing small parts. Carburizing by this method was developed two years ago in the German plant of the concern. Since then the method has been widely tested by the largest metal-working concerns in Germany and in large automotive plants of this country.

It is stated that from two to three times the penetration obtained in a given time with other methods is obtainable with this new carburizing liquid. A pot life up to 1200 hours is obtained when Perliton is used. Other advantages claimed include uniformity in the depth of case and carbon content of parts; low cost per ton of steel; no decarburization; non-hygroscopic properties; high thermo-conductivity; low consumption; no variation in the degree of fluidity; reduced heating time; and no rust after water quenching.

With the Perliton process, the same kind of carburized case is obtained as is produced by any of the solid carburizers that require pack-hardening. The surfaces of the carburized parts can be ground and they remain file hard, provided the grinding does not extend beyond the euctectoid area.

Littell Air Valve for Punch Presses

An air valve of unusually large capacity for use in blowing comparatively big pieces away from the dies of power presses is being introduced on the market by the F. J. Littell Machine Co., 4127 Ravenswood Ave.. Chicago, Ill. The illustration shows this valve fitted to a machine. The air blast is released by means of a roller that engages a cam on the crankshaft of the press. This cam is set to shut off the air when the press stops at the top of the stroke.

A flexible hose connects the air valve with the nozzle. The nozzle is supported by a universal clamp which enables the operator to position it at any height and to adjust it quickly to the left or right or to the front or back by merely loosening and tightening a wing nut. This valve can be applied to hand or automatically fed presses.

Motorized Countershafts for Machine Tools

Motorized countershafts complete with a ball-bearing motor, ball-bearing speed reducer, and outboard ball bearing, all mounted on a single base for ready application to various types of machine tools, have recently been brought out by the Production Equipment Co., 5217 Chester Ave., Cleveland, Ohio. Manually operated reversing drums are regularly furnished on these countershafts, but the drums may be omitted if desired. An adjustment provides for taking up belt stretch and facilitates shifting of the belts from one pulley step to another.

The illustration shows one of these motorized countershafts installed on a milling machine. The unit makes a machine tool self-contained and entirely independent of lineshafts. Only four bolts are required for mounting the unit on the machine. Various minimum speeds can be provided.

Magnusol—a New Metal-Cleaning Chemical

Magnusol is the name of a chemical that is being placed on the market by the Magnus Chemical Co., Garwood, N. J., for cleaning oily dirt from metal parts. In using Magnusol, the articles to be cleaned are dipped

in the solvent or if they are too large for this method, the solvent is painted or sprayed on them. Then the parts are rinsed in cold water, preferably under pressure.

Following the rinsing, the metal parts should go through the ordinary routine "platers' cleaner" and rinsing operations that usually precede metal finishing. Magnusol will not leave a chemically clean surface. Work cleaned by it will be noticeably cleaner, but will show water breaks.

In general, Magnusol is used in an open still tank, and the work should be allowed to soak in the solution for a few minutes. The dip may be cold, but penetration is more rapid if the solution is heated to 140 degrees F. When the work has irregular, embossed, recessed, or threaded surfaces, or has been sandblasted, it should be agitated.

Fox Hydraulic Forcing and Broaching Press

A three-ton machine recently added to the series of hydraulic forcing and broaching machines built by the Fox Machine Co., Jackson, Mich., is shown in the accompanying illustration. This machine is actuated by a Vickers hydraulic feed pump. The pump and its driving motor are mounted on a bracket, forming a unit that can be lifted free from the machine frame together with the suction line, after the oil-delivery pipe line has been disconnected. In like manner, the cutting compound pump is mounted with its driving motor on a bracket that can be conveniently removed from the lower part of the frame. The column of the machine serves as a reservoir for the oil and the base contains the cutting compound.

The hydraulic control valve is located in a recess at the back of the frame. When the operator steps on the pedal or pulls down the hand-lever, this control valve is latched in position to provide a downward movement of the ram. It is unnecessary for the operator to keep his foot on the pedal or his hand on the lever during the working stroke. As soon as the desired depth of stroke has been reached, the ram returns automatically to its top position. At any time during the downward stroke, the operator can push the hand-lever up and start the upward movement of the ram. When the ram reaches its upper set position, the pump delivery is by-passed so that the ram does not work against pressure.

The nose of the ram carries an arm that supports a vertical rod provided with two stops. One of these stops determines the depth of the stroke and the other the position to which the ram is returned on its up stroke. The long bearing of the ram in the lower end of the frame head insures an adequate support even when the ram is extended. Compound is delivered to the broach only when the ram is moving downward.

The machine illustrated weighs approximately 1900 pounds, equipped with the motor. It may be supplied with tables of various heights to suit the work to be handled.

Fox Broaching Press of Three Tons Capacity

Porter-Cable Tungsten-Carbide Tool Lapping Machine

A Type D-5 lapping machine intended primarily for the sharpening of tungsten-carbide tools has been brought out by the Porter-Cable Machine Co., Syracuse, N. Y., to supersede the Type D-4 machine described in July, 1933, MACHINERY, page 745. The same machine may also be used for lapping high-speed steel tools used in working the softer metals or for lapping gages, dies, and other parts.

All the mechanism of the machine is fully enclosed, the motor and driving parts being housed in a streamline frame which also serves as a pedestal. A ball-bearing motor of vertical type is employed. Various speeds are obtained by opening a door and changing a V-belt to different steps on the pulleys. Speeds of 600, 900, 1200, and 1800 revolutions per minute are obtained with the motor running at 1800 revolutions per minute.

Although the illustration shows the machine equipped with an adjustable carriage and an

Porter-Cable Lapping Machine of Enclosed Design

adjustable rail, it can be supplied without these members. The purpose of the carriage is to hold the tool at the proper angle and with the correct pressure while it is being lapped. A Belgian iron disk 11 1/4 inches in diameter is furnished as standard equipment, but disks of domestic iron in other sizes can be supplied. The disk is carefully balanced after machining to prevent vibration.

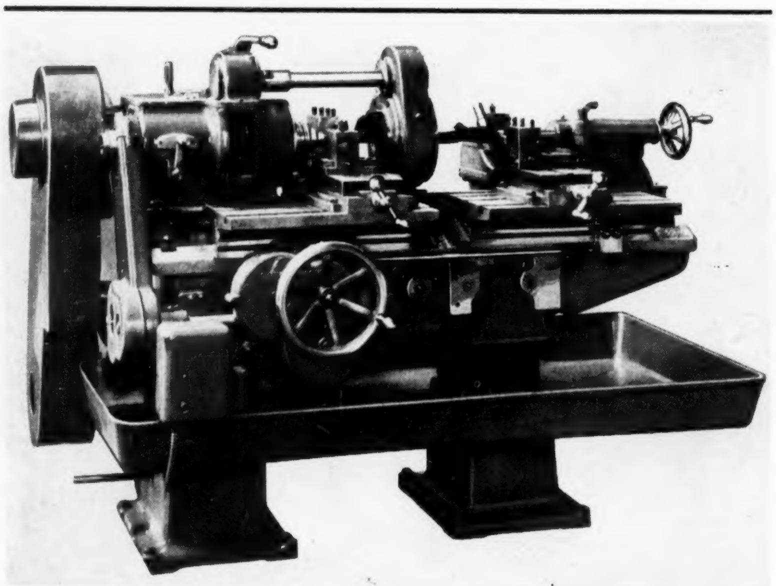
When equipped with an abrasive disk cemented to the cast-iron disk, the machine can also be used for removing burrs from parts and for other types of hand grinding after milling, stamping, or screw machine operations have been performed on parts.

LeBlond Center-Drive Multi-Cut Lathe

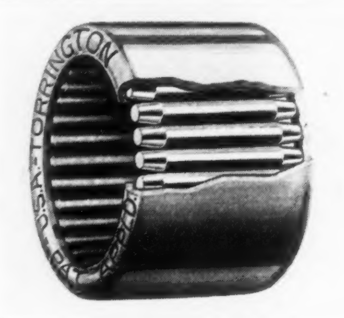
Short motor shafts and similar parts can be turned and faced simultaneously on both ends by a multi-cut lathe recently built by the R. K. LeBlond Machine Tool Co., Cincinnati, Ohio. The principal feature of this machine is a unit that drives the work from the center and thus leaves the ends clear for the cutting tools.

Different driving members can be applied to the center-drive unit to adapt the equipment for handling a variety of work. Equalizing type drivers can be provided for parts that are not sufficiently rigid to be driven by means of a simple lug type driver. With an equalizing driver, the work is solidly clamped without distortion. By clamping near the center of the piece, unusual rigidity is obtained for turning and facing cuts.

The speed of the center-drive unit is variable through the lever-controlled six-spindle headstock. The maximum speed of the center-drive unit is 560 revolutions per minute. This speed is sufficient to permit using tungsten-carbide tooling on cast-iron parts with diameters down to about 1 inch, which is ordinarily the smallest practicable diameter to which parts can be machined simultaneously on both ends unless the surfaces are extremely short in length. Feeds as low as 0.002 inch per revolution of the spindle are obtainable; hence, the feeds are also suited for the use of tungsten-carbide cutters, as well as high-speed steel tools.



Le Blond Multi-cut Lathe Arranged for Machining Both Ends of Parts Simultaneously



Needle Bearing Made by the Torrington Co. in a Wide Range of Sizes

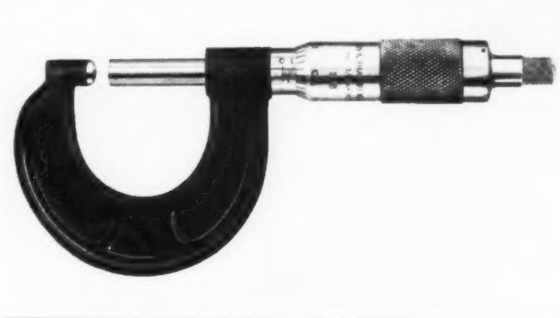
Torrington Needle Bearings

Bushings or bearings with a large number of needle-like rollers that permit the bushings to be made with outside diameters comparable to those of bronze and babbitt bushings are being introduced on the market by the Torrington Co., 55 Field St., Torrington, Conn. The outside shell of these bearings is drawn from steel, and it is cyanide-hardened to give a smooth, long wearing bearing surface. The needle rollers are held in place by the shell without the need of separate retaining rings or washers. The rollers are made from high-carbon steel, hardened and centerless-ground.

The use of needle rollers, together with the turned-in ends or lip construction of the shell, provides a large storage capacity for lubricant. The rollers are entirely covered with grease or oil, so that the moving member actually revolves on a film of lubricant.

These needle bearings are regularly made in a large number of sizes, having a bore diameter of from 1/2 to 1 3/4 inches. The outside diameter ranges from 11/16 inch to 2 1/8 inches, and the length from 1/2 inch to 1 1/2 inches. There are twenty-nine rolls, 0.0606 inch in diameter, in a 1/2-inch bearing, and forty-three rolls 0.1378 inch in diameter in a 1 3/4-inch bearing.

These bearings have radial load capacities as high as 8280 pounds.



Micrometer Caliper for Measuring the Thickness of Tube and Pipe Walls

Three Types of Automatic Motor Starters Made by the Lincoln Electric Co.

B & S Micrometer Caliper for Tubes

The thickness of tubing and pipe 17/32 inch and up in inside diameter can be measured by means of a No. 228 micrometer caliper, which has been added to the line of small tools made by the Brown & Sharpe Mfg. Co., Providence, R. I. This micrometer has a range of from 0 to 1 inch and is graduated in thousandths of an inch. It will be seen from the illustration that the anvil is rounded on the end and that it projects sufficiently from the frame to make it easy to take measurements.

Lincoln Automatic Motor Starters

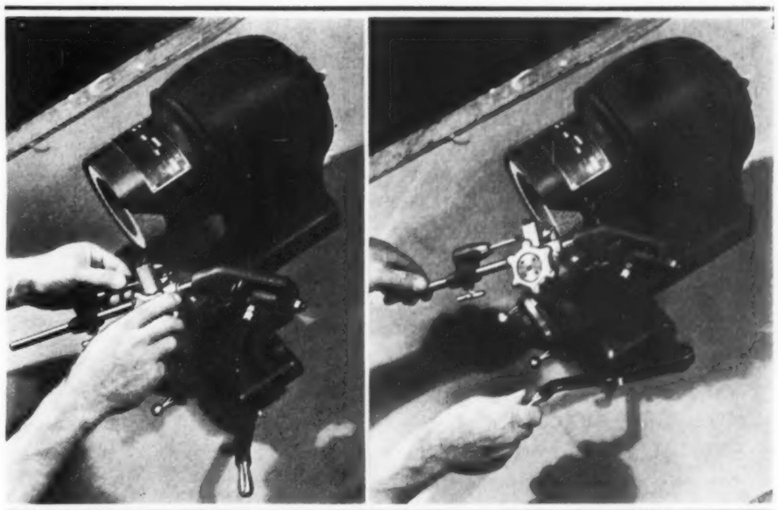
A line of automatic motor starters that prevent accidental starting and permit taking full advantage of the capacity of a motor without danger of burning it out has been developed by the Lincoln Electric Co., Cleveland. Ohio. With these starters, which are of the across-the-line type, it is impossible to close the starting current unintentionally. On two of the three types, a red stop button extends around and beyond a recessed green start button, as will be seen from the illustration. Consequently, a bump against the control would move only the stop button. When the motor is once stopped, the only way it can be started is by pressing the recessed button with the finger tip.

A reverse time-limit protection which allows of carrying a small overload for a long time or a heavy load for a short time makes it possible to take full advantage of the capacity of the motor. These new starters are furnished for motors from 3 to 30 horsepower, and for operation on current of 110, 220, 440, and 550 volts.

Sellers Small Drill Grinder

Two-lip twist drills from 1/16 to 1/2 inch in diameter can be ground to any included angle from 80 to 160 degrees in a bench type machine recently added to the line of drill grinding machines built by William Sellers & Co., Inc., 1602 Hamilton St., Philadelphia, Pa. This machine has been brought out not only for sharpening dull drills rapidly and accurately, but also for reclaiming broken drills so economically as to do away with the common practice of discarding them in large quantities. The chucking and grinding principles on which the larger drill grinders made by this concern are based have been incorporated in the smaller machine to insure the same accuracy and speed.

The convenience of the chuck is the principal feature of the machine. The chuck is quickly opened and closed by merely turning a handwheel, as shown at the left in the illustration. The drill is held at three points by two hardened steel jaws which



(Left) Loading the Sellers Drill Grinder. (Right) The Drill Grinding Operation

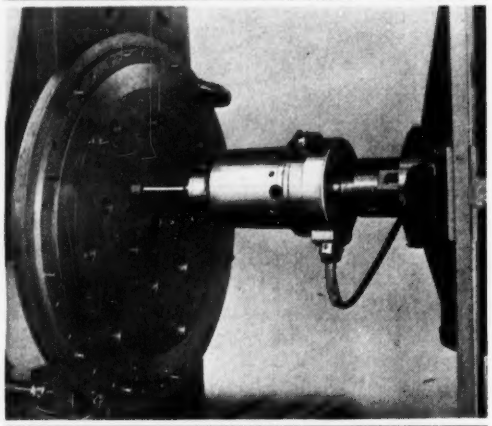


Fig. 1. Olofson Precision Grinder Applied to a Horizontal Boring Machine

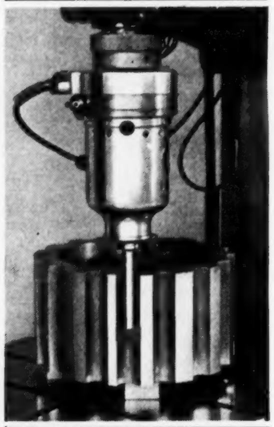


Fig. 2. Using the Olofson Grinder Vertically

grip on the edges of the flutes as close as possible to the cutting lips, and also by an adjustable center which supports the drill shank. The chuck holds the drill so that its axis is moved in the correct relation to the axis of the wheel to automatically provide clearance that increases correctly from the periphery to the point of the drill. This holds true for all sizes of drills within the range of the machine.

In operation, the left hand of the operator swivels the bar on which the chuck is mounted, as shown in the right-hand view of the illustration, to bring the entire lip of the drill in contact with the grinding wheel. At the same time, the right hand of the operator moves a lever to feed the drill back and forth across the face of the grinding wheel. This movement keeps the wheel face true. After one lip has been ground, the second lip is set in the identical position and ground in the same manner. This insures identical lips and concentricity of the drill point with the axis of the drill. Thus lips of equal angle, length, and clearance are insured.

The grinding wheel is of the cup type. It is 5 inches in diameter, and is mounted direct on the armature shaft of a built-in motor. A wheel-dresser is supplied which is substituted for the chuck when truing is necessary. The motor is 3/8 horsepower, and is equipped with ball bearings.

Olofson Precision Grinder for Machine Tools

A grinding attachment or head that is applicable to various types of machine tools for use in the precision grinding of dies or other work has recently been developed by the Buell Die & Machine Co., 3545 Scotten Ave., Detroit, Mich. This grinder is shown in Fig. 1 being used on a horizontal boring mill for accurately grinding a number of holes in a plate that has been hardened. Precise center-to-center distances are insured by moving the machine spindle only.

The grinder may also be employed to increase the scope of jig boring machines, in which case it is used vertically, as illustrated in Fig. 2. The operation here shown consists of grinding half-holes in a hardened roll. The graduated rotary table with which the machine is equipped makes it a simple matter to index the work accurately from hole to hole. The grinder may also be conveniently employed in a lathe for performing various internal and external grinding jobs. It is held in machine spindles by means of a tapered shank.

The idling speed of the grinder is 13,000 revolutions per minute, while the actual working speed is 10,000 revolutions per minute. The motor case revolves at the speed of the machine spindle, which should be about 60 revolutions per minute. Holes up to 4 inches in diameter can be ground. The grinding wheel has an eccentric rotation, the total amount of eccentric adjustment being 1 1/4 inches. Three interchangeable grinding wheel spindles are provided.

Strip-Steel Polishing Machine and Angle-Plate Grinder

The Standard Electrical Tool Co., 1938 W. 8th St., Cincinnati, Ohio, has recently developed a machine for cleaning and polishing strip steel as it comes from electric hardening and tempering furnaces. It is the practice to use one machine for cleaning off the scale from the strip stock and another machine for polishing. From Fig. 1. it will be seen that the machine is provided with vertical adjustments to compensate for wear of the wheels. There is a guide shoe at each wheel. This machine can also be used for performing a similar operation on wire of all sizes.

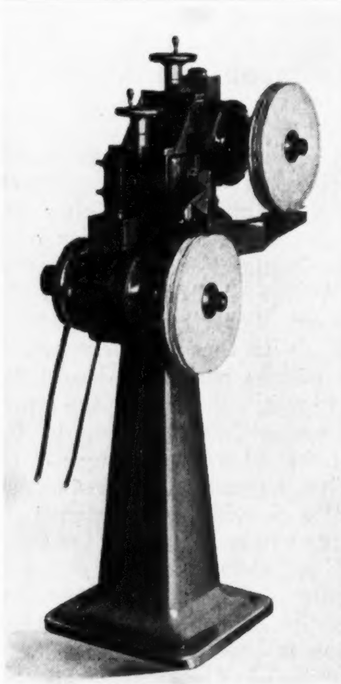


Fig. 1. Strip-steel Cleaning and Polishing Machine

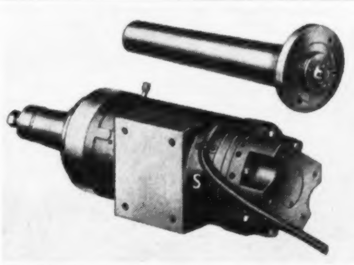


Fig. 2. Angle-plate Grinder Applicable to Various Machines

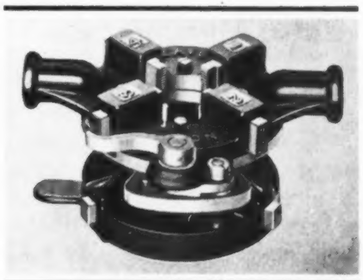
The same concern is also placing on the market at this time the combination angle-plate grinder shown in Fig. 2. This is a versatile unit which can be conveniently mounted on a boring mill or a planer by means of pads that are provided for the motor housing. A plain angle-plate can be furnished for attachment to a lathe.

This grinder is driven by a five-horsepower motor. The motor shaft is fitted with two ball bearings and the grinding wheel spindle with three. The motor runs at 3600 revolutions per minute. The unit can be furnished with a solid spindle or with a clutch arrangement that provides for interchanging short and long extensions. A vertical or a horizontal feed can be furnished or both of these feeds.

Beaver Die-Stocks and Pipe Reamer

Die-stocks designed particularly for threading brass and copper pipe without marring the work have been added to the line of Beaver pipe tools made by the Borden Co., Warren, Ohio. These die-stocks can also be used for threading iron, steel, and aluminum pipe. Stocks of both plain and ratchet types are available, the plain type being shown in the illustration. Threads from 1/8 to 1 1/4 inches can be cut by the No. 70 die-stock, and threads from 1/4 to 2 inches by the No. 72 stock.

The same concern has also brought out a hand reamer with a swiveling action for reaming pipe from 1/8 to 2 inches. The reamer head is made of alloy steel, heat-treated, and it can be sharpened repeatedly. When finally worn out, the head can be replaced.



Beaver Die-stock for Threading Brass Pipe without Marring

Cowles Milling Cutter with Parallel-sided Blades

Cowles "Rigidback" Milling Cutters

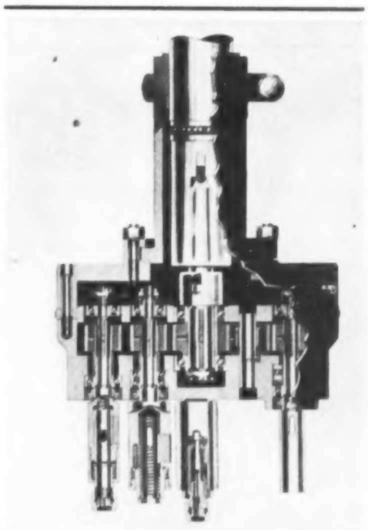
Inserted-tooth milling cutters made up of blades which have their back surface ground parallel with their cutting side are being introduced on the market by the Cowles Tool Co., 2086-96 W. 110th St., Cleveland, Ohio. The back surface of these blades is held firmly against a corresponding slot in the cutter body by a wedge of double taper which is placed in front of the blade. The blade and wedge assembly form a dovetail tooth that is capable of withstanding heavy strains. Unusual rigidity is claimed for this construction, and for that reason, the manufacturer has adopted the trade name of "Rigidback" for these cutters.

Serrations on the front of the blades and on the back of the wedges permit radial adjustment of the blades for increasing the diameter of the cutters. The cutter bodies and wedges are regularly made of heat-treated alloy steel, and the blades of high-speed steel, although the design is suited to the use of blades tipped with cemented carbide. While the illustration shows a shell end-mill, the standard line includes eight different styles of cutters and fifty-one sizes.

Buhr Multiple Drilling and Tapping Heads

Multiple drilling and tapping heads of the design here illustrated are being introduced on the market by the Buhr Machine Tool Co., Ann Arbor, Mich. The adapter and the driver supplied on these heads are of standardized design and are interchangeable on all Buhr heads. This feature means a considerable saving when machines are being retooled.

The spindles are made from chrome-nickel steel. They are hardened and have ground tapers or sockets to receive adjustable collets. The spindles are



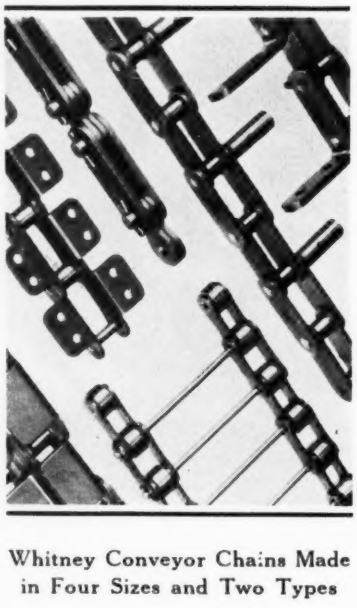
Buhr Multiple Drilling and Tapping Head with New Features

mounted in preloaded ball bearings. The spindle and drive gears are spline-broached to suit the splines on the spindles. The idler gears run on ball or needle-type anti-friction bearings. A self-locking measured type of vertical spindle adjustment is provided. Floating tap chucks are supplied. The drill and tap collets are of the lock-release type made by the same company.

Whitney Conveyor Chains

Four different sizes and two types are included in a new line of conveyor chains being placed on the market by the Whitney Mfg. Co., Hartford, Conn. Standard and over-size rolls can be supplied with these chains. The chains in the new line are of all-steel construction. An extended-pitch design provides light weight combined with high wear-resisting qualities and strength.

Both the 500 and 550 series of this chain operate over cut sprockets, but the use of a large-diameter roll on the 550 series allows this chain to be used as a drag or pressure chain, with the rollers carrying the load. Both series can be furnished with standard or special attachments. They are made in pitches of 1 1/2, 2, 2 1/2, and 3 inches.

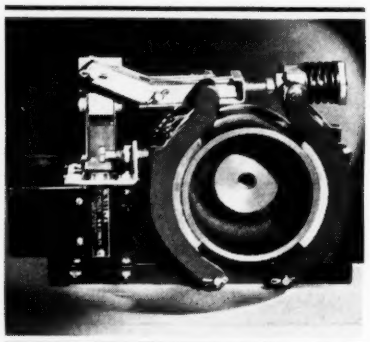


Whitney Conveyor Chains Made in Four Sizes and Two Types

Cutler-Hammer Small Electric Brakes

A line of small alternating- and direct-current solenoid-operated brakes now being placed on the market by Cutler-Hammer, Inc., 12th and St. Paul Ave., Milwaukee, Wis., includes units with torque ratings ranging from 3 foot-pounds to 75 foot-pounds.

The brake wheel is made relatively large, permitting low total brake-shoe pressures which are distributed over a large lining area. The low shoe pressures result in a long, even wear of the friction surfaces, pins, and pivot points. They also enable a small operating solenoid to be used.



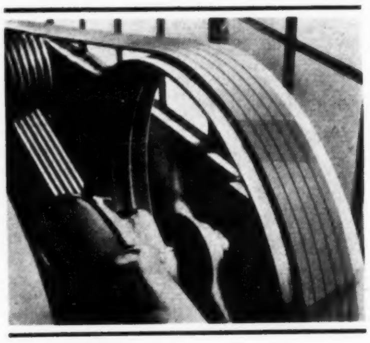
Cutler-Hammer Electric Brake Applicable to Machine Tools

These brakes are intended for application to machine tools, conveyors, small hoists, dumbwaiters, small elevators, printing presses, and other equipment that requires quick stopping.

Dayton V-Flat Drives

V-flat belts for driving refrigerators, pumps, compressors, etc., have been supplied in large quantities during past years by the Dayton Rubber Mfg. Co., Dayton, Ohio. This concern has now made belts of this type available for general industrial service, for transmitting up to 300 horsepower or even more.

V-flat drives differ from regular V-belt drives in that the large pulley is flat and only the small pulley is grooved. The bottom surface of the V-belt rides on the flat surface of the large pulley. Belts are designed specifically for this class of service, being made with a comparatively wide and flat bottom.



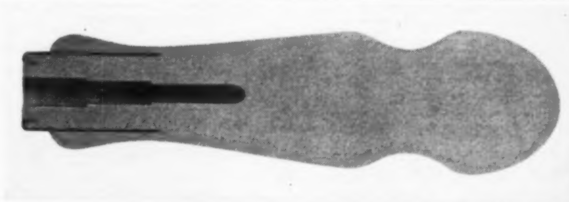
Dayton V-flat Drive which Employs Grooved and Flat Pulleys

These belts are intended for use in short center drives where the center distance between the pulleys is approximately equal to or slightly less than the diameter of the large flat pulley. Longer center distances may be used, but a greater number of belts is required in that case to prevent slippage on the large pulley. The speed ratio between the two pulleys should be approximately 3 to 1.

Osgood "Balanced Grip" File Handle

Correct hand and finger balance is the advantage claimed for the "Indestructible" file handle here illustrated, which is a recent development of the J. L. Osgood Machinery & Tool Co., Inc., 43-45 Pearl St., Buffalo, N. Y. In using a file equipped with this handle, the third finger rests in the annular groove. It is stated that with this new design of handle, there is an even tension on each finger and hand muscle and that a comparatively light grip is required in taking heavy file cuts. Also, there is no tendency for the hand to slip forward on the file handle, even when applying a severe cutting pressure.

The file end of the handle is of the same construction as the handle illustrated in May MACHINERY, page 576. A long metal ferrule which is pressed into the wood is doubly reinforced at the outer end to withstand the heavy pressure that the file tang exerts at this point, and thus prevents splitting. The internal diameter of the ferrule is such as to provide a large amount of wood for cushioning. The three steps of the center hole drilled in the wood conform approximately to the taper of file tangs, so as to guide the tang.



Osgood File Handle Designed to Permit an Even Tension on Hand and Finger Muscles

Polytechnic Evening Course in Kinematics

The post-graduate evening course in kinematics in machine design which was given last year as an experiment by the Polytechnic Institute of Brooklyn was so well received by the students that the institute has decided to offer it again this year. It differs from the usual courses in mechanisms given by most of the American colleges in that it does not deal with the various mechanisms individually, but lays particular stress on the general and fundamental laws underlying the motion of rigid bodies and their application to a great variety of problems taken from all fields of engineering. In addition, it deals with the analysis and classification of all existing mechanisms, and with the development of new mechanisms (kinematic synthesis).

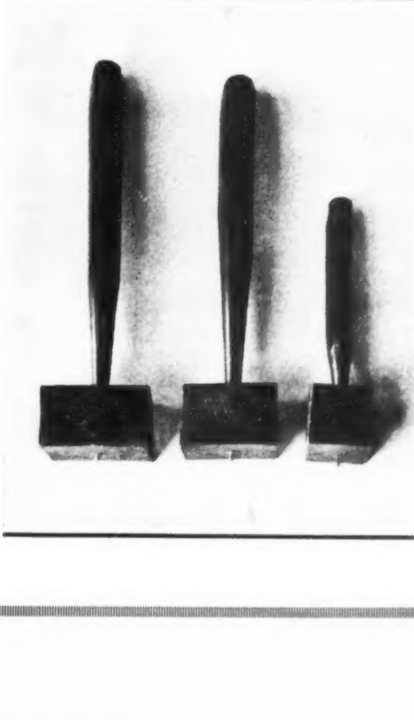
The course will again be given by R. de Jonge, who has been associated for many years with the modern development of kinematics as applied to machine design. It begins on September 27.

* * *

The Warner & Swasey Co., Cleveland, Ohio, reports that the company's total business in turret lathes for the first six months of 1934 showed an increase of 110 per cent as compared with the same period in 1933.

New Method of Making Endless Belts

The tendency of the outside seams of endless belts to open up during severe service is said to be eliminated by the use of the Plylock belt joint, recently developed by the B. F. Goodrich Co., Akron, Ohio. In this joint, the seam is embedded or countersunk below the surface of the belt in such a position as to relieve the seam from strain and to shield it from wear or windage. This protection is given by a thick cushion of rubber reinforced with bias fabric which is permanently vulcanized into position. The construction will be used in all Goodrich factory-built endless belts, and it is the plan to license agents, jobbers, and users to make these belt joints themselves.



The illustration shows three blocks of 0.15 to 0.20 per cent carbon steel, 1 inch thick, through which have been driven sharp-pointed punches made from the ordinary variety of old files. The punch points that pierced these steel blocks without breaking were specially heat-treated by James Cran of Plainfield, N. J., well known as an expert in the heat-treatment of iron and steel and an authority on forging processes.

Quill Roller Bearings for Aircraft

The quill type of roller bearing is now being applied in the construction of aircraft. The new Vultee transports being constructed for the American Airlines incorporate Bantam antifriction quill bearings in the control mechanism, as well as in the bearings of the tail wheel assembly and in the transmission that operates the wing flaps and retractable landing gear.

* * *

The Louis Allis Co., Milwaukee, Wis., manufacturer of motors and generators, states that the sales for the first half of 1934 were more than three times those for the same period last year.

NEWS OF THE INDUSTRY

California

ARTHUR C. GELDNER has been made district sales manager of the Union Drawn Steel Co., Massillon, Ohio, for the Pacific Coast territory. Mr. Geldner will maintain offices at 915 Edison Bldg., Los Angeles, Calif., with sub-district offices in San Francisco and Seattle, Wash. He became associated with the Union Drawn Steel Co. in 1920, but was forced by illness to retire in 1930. In 1932, he returned to the concern and became sales representative connected with the Los Angeles offices of the Republic Steel Corporation, parent corporation of the Union Drawn Steel Co.

RICH MFG. CO., LTD., 3851 Santa Fé Ave., Los Angeles, Calif., announces that a contract has been made under which the company will manufacture the complete line of electrodes and other products made by the KARL STROBEL CORPORATION, including arc-welding generators and cutting equipment.

JENISON MACHINERY CO., 20th and Tennessee St., San Francisco, Calif., has been appointed distributor of Rex construction equipment in the northern part of the state of California by the Chain Belt Co., Milwaukee, Wis.

Illinois and Missouri

LINK-BELT CO., 910 S. Michigan Ave., Chicago, Ill., announces several new appointments in its Positive Drive Division. G. H. BURKHOLDER, formerly of Philadelphia, has been appointed western sales manager, with headquarters at Indianapolis. W. H. KINKEAD has been made manager of sales of Link-Belt speed reducers, with headquarters in Philadelphia, succeeding Mr. Burkholder. G. L. GANSZ succeeds Mr. Kinkead and will henceforth be responsible for the Philadelphia office sales of the Positive Drive Division.

JAMES J. DALE has been elected vice-president in charge of sales of the All-steel Press Co, 12015 S. Peoria St., Chicago, Ill. Mr. Dale was formerly vice-president in charge of sales for the Henry & Wright Mfg. Co., Hartford, Conn., in the Chicago and Detroit territories.

J. J. RICHARDS has been appointed manager of the vibrating screen department of the Link-Belt Co., 910 S. Michigan Ave., Chicago, Ill., succeeding HARRY L. STRUBE, who has been promoted to the position of assistant chief engineer of the company's Philadelphia plants.

NELS A. TORNBLOM has been appointed chief engineer of the Appleton Electric Co., 1701 Wellington Ave., Chicago, Ill., succeeding E. G. K. ANDERSON.

PRODUCTION TOOL & SUPPLY CO., 2832 Easton Ave., St. Louis, Mo., has been appointed district representative for the state of Missouri by the Hevi Duty Electric Co., Milwaukee, Wis., manufacturer of electric heat-treating furnaces.

Michigan and Wisconsin

TAYLOR-WINFIELD CORPORATION, Warren, Ohio, has opened a new plant in Detroit, Mich., located at 14307 Third Ave. The Detroit plant will have a complete engineering staff, experimental department, machine shop, transformer department, assembly department, and facilities for manufacturing special resistance welders, as well as a department for redesigning and rebuilding used equipment. The main plant at Warren, Ohio, will continue to manufacture standard machines, as well as special resistance welding equipment.

REPUBLIC STEEL CORPORATION, Youngstown, Ohio, has appointed the BUHL SONS CO., Detroit, Mich., distributor of Toncan iron.

FRED C. DOEPKE, for several years secretary of the Wrought Washer Mfg. Co., of Milwaukee, Wis., manufacturer of all types of washers and stampings, was elected president of the company at the annual meeting of the board of directors. Other officers elected are: CHARLES H. DISCH, vice-president; and WILLIAM F. DISCH, secretary and treasurer.

New England

R. R. WEDDELL of Ansonia, Conn., formerly chief engineer and sales manager of the O. K. Tool Co., Inc., Shelton, Conn., recently returned to the United States from Great Britain, where he acted as consulting engineer to Richard Lloyd & Co., Ltd., Birmingham, in the design, manufacture, and sales promotion of inserted-blade metal-cutting tools. Mr. Weddell states that conditions are very satisfactory in the British machine and tool industries and that many of the shops there are working over-time.

L. HERES DE WYK & SON, Derby, Conn., have been appointed exclusive agents in the state of Connecticut for the Zeh & Hahnemann Co., Newark, N. J., builder of presses of various types.

PERCY JENKINS has been appointed New England district sales manager of the Wickwire Spencer Steel Co., with offices at 80 Webster St., Worcester, Mass. For the past year he has served as acting sales manager of the eastern district, with offices in New York.

New York

GEORGE C. GREEN, of the class of 1934, Stevens Institute of Technology, has joined the technical staff of the Acheson Colloids Corporation, Port Huron, Mich. Mr. Green will be located in New York City, where he will be first assistant to Raymond Szymanowitz, technical editor of the corporation.

EDWIN C. STOUT has been appointed sales manager of the eastern district sales department of the Wickwire Spencer Steel Co., with offices at 41 E. 42nd St., New York City. Mr. Stout's experience in the steel industry covers more than a quarter of a century.

HAROLD E. TRENT CO., 618-640 N. 54th St., Philadelphia, Pa., manufacturer of electric heating units and electric furnaces, has opened an office at 143 Liberty St., New York City. A. H. GURTNER is in charge of the new office.

REVERE COPPER & BRASS, INC., 230 Park Ave., New York City, announces the opening of an office at 911-912 Rhodes-Haverty Bldg., Atlanta, Ga. WALTER W. FITTS is district representative.

Ohio

CHARLES M. REESEY has been appointed advertising manager of the Cincinnati Milling Machine Co. and Cincinnati Grinders Inc., Cincinnati, Ohio. Mr. Reesey entered the employ of the company as a University of Cincinnati co-operative engineering student in 1923. After graduating in 1928, he was employed in the advertising and sales departments, and during the last six years has been closely associated with the company's advertising and publicity work. Mr. Reesey has also been secretary and vice-president of the Cincinnati Association of Industrial Marketers.

J. W. MULL, JR., 333 N. Pennsylvania St., Indianapolis, Ind., representative of manufacturers of production tools, has opened a new office at 6007 Euclid Ave., Cleveland, Ohio, with F. J. KERN in charge. Mr. Kern was formerly superintendent of the National Acme Co., and later factory manager of the Gabriel Mfg. Co. For the last three years he has been superintendent of the Accurate Parts Co., of Cleveland.

Pennsylvania

LOUIS E. MURPHY, formerly president of E. F. Houghton & Co., 240 W. Somer-


-NEW-
Brown & Sharpe Tools
B·S
A wide variety of new tools, new designs and new sizes—each filling a definite need. A New Tools Booklet, supplementing our Small Tools and General Catalogs will be sent to anyone interested.
Brown & Sharpe Mfg. Co., Providence, R.I., U.S.A.

set St., Philadelphia, Pa., was made chairman of the board at a special meeting of the stockholders on July 20. Mr. Murphy has been connected with the company for forty-four years. At the same meeting, MAJOR AARON E. CARPENTER was elected president and general manager. Major Carpenter has been with the company for twenty-nine years, and represents the third generation of Carpenters to occupy the presidency of the company. Other officers elected were GEORGE W. PRESSELL, vice-president and director of sales; A. EVERLY CARPENTER, 3rd, secretary; C. P. STOCKE, assistant secretary; DR. R. H. PATCH, treasurer; and Miss M. M. MENNINGEN, assistant treasurer.

Major Aaron E. Carpenter, President and General Manager of E. F. Houghton & Co.

ANDREW D. HUNT has been appointed manager of engineering of the South Philadelphia Works of the Westinghouse Electric & Mfg. Co. Mr. Hunt has been connected with the Westinghouse organization in various capacities since 1919. He previously held for five years the position he now occupies.

W. T. DAVIDSON has been appointed manager of the Machine Parts Division of the Struthers-Wells Co., Warren, Pa. Mr. Davidson has been in charge of development, research, and other technical activities of the company for several years.

R. E. S. GEARE, formerly chief engineer of the L. H. Gilmer Co., Tacony, Philadelphia, Pa., was elected vice-president in charge of sales and engineering at a recent meeting of the board of directors.

WYCKOFF DRAWN STEEL CO. announces the removal of its general offices from Ambridge, Pa., to Suite 1308 First National Bank Bldg., Pittsburgh, Pa.

OBITUARIES

WILLIAM R. FOX, president of the Fox Machine Co., Jackson, Mich., died July 20 from injuries due to a fall. Mr. Fox was born in Middletown, Conn., in 1853, and received his early mechanical training at the Worcester Polytechnic Institute. He went to Michigan in 1880, settling in Grand Rapids, where he engaged in the building of woodworking machinery; in the course of this work, he patented furniture casters which were universally used for many years. He also patented steel window sash pulleys that have also been largely used. Subsequently, he engaged in the building of bicycles and bicycle tools, and following that, took up the manufacture of typewriters.

In 1916, he erected the present plant of the Fox Machine Co., in Jackson, Mich., and engaged in the building of special machinery for automobile manufacturing and other high-production work.

In 1926, due to ill health, he relinquished active management of the plant, but re-entered active service in 1933.

WILLIAM HASTINGS BASSETT, metallurgical manager of the American Brass Co., Waterbury, Conn., and newly elected president of the American Society for Testing Materials, died suddenly July 21 at his home in Chesire, Conn., at the age of sixty-six years. Mr. Bassett was a pioneer metallurgist in the brass industry. In 1925, he was awarded the James Douglas medal for research in copper and brass and other non-ferrous metals. He was the first to apply the spectroscope to routine work in the non-ferrous metal industry, and the first in this country to apply the microscope to the metallography of non-ferrous metals. He was a past-president of the American Institute of Mining and Metallurgical Engineers, a former director of the American Institute of Chemical Engineers, and a member of the Society of Automotive Engineers, the American Society of Mechanical Engineers, the American Chemical Society, and the British Institute of Metals.

C. A. DONOVAN, assistant superintendent of the Cimatool Co., Dayton, Ohio (formerly the City Machine & Tool Works), died July 13 in an automobile accident while on his way to attend the Century of Progress Exposition in Chicago. Mr. Donovan was forty-eight years old. He had been in the employ of the company for eighteen years.

COMING EVENTS

SEPTEMBER 20-22—Convention of the NATIONAL INDUSTRIAL ADVERTISERS' ASSOCIATION, at Cincinnati, Ohio. For further information, address Gregory H. Starbuck, General Electric Co., Schenectady, N. Y.

OCTOBER 1-5—NATIONAL METAL CONGRESS AND EXPOSITION, Commerce Hall, Port Authority Bldg., New York City. W. H. Eisenman, 7016 Euclid Ave., Cleveland, Ohio, director.

OCTOBER 1-5—Annual convention of the AMERICAN SOCIETY FOR METALS (formerly the American Society for Steel Treating), New York City. W. H. Eisenman, 7016 Euclid Ave., Cleveland, Ohio, secretary.

OCTOBER 1-5—Fall meeting of the AMERICAN WELDING SOCIETY at the Hotel New Yorker, New York City. M. M. Kelly, secretary, 33 W. 39th St., New York City.

OCTOBER 1-5—Annual meeting of the WIRE ASSOCIATION at the Hotel New Yorker, New York City. R. E. Brown, secretary, 17 E. 42nd St., New York City.

OCTOBER 1-5—Fall meeting of the IRON AND STEEL DIVISION of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at the Hotel Pennsylvania, New York City. P. T. Wetter, assistant secretary, 29 W. 39th St., New York City.

OCTOBER 1-5 — Twenty-third annual SAFETY CONGRESS AND EXPOSITION, to be held at Cleveland, Ohio, under the auspices of the NATIONAL SAFETY COUNCIL, INC., 20 N. Wacker Drive, Chicago, Ill.

OCTOBER 10-11—Production meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS to be held at the Book-Cadillac Hotel, Detroit, Mich. John A. C. Warner, general manager, 29 W. 39th St., New York City.

OCTOBER 22-26—Annual meeting of the AMERICAN FOUNDRYMEN'S ASSOCIATION and Fifth International Foundry Congress and Exposition in the New Auditorium, Philadelphia, Pa. C. E. Hoyt, executive secretary-treasurer, 222 W. Adams St., Chicago, Ill.

NOVEMBER 8-24—Exposition of machinery and tools at Olympia, London, England.

DECEMBER 3-7—Annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at the Engineering Societies Building, 29 W. 39th St., New York City. Calvin W. Rice, secretary, 29 W. 39th St., New York.

DECEMBER 3-8 — ELEVENTH NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING at the Grand Central Palace, New York City. Manager Charles F. Roth, International Exposition Co., Grand Central Palace.